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APPLICATION OF MODERN TECHNOLOGIES TO INTERNATIONAL DEVELOPMENT

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INTRODUCTION

Application of Modern Technologies to International Development is a new publication series sponsored jointly by the Agency for International Development and the National Technical Information Service (NTIS), United States Department of Commerce. The purpose of the series is to increase the ready availability of U.S. technical publications of special interest in developing countries to scientists, engineers, and planners in industrial and technological research institutions, universities, and government agencies to foster the transfer of technology to these countries.

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Prices of the reports, listed by order number, appear on page 105.

ABOUT NTIS

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CHEMISTRY

Beneficiation
and Refining

CONTINUOUS GASEOUS DIRECT REDUCTION OF LOW-GRADE IRON ORES IN A FLUID-BED REACTOR

Bureau of Mines, Tuscaloosa Metallurgy Research Laboratory. E. G. Davis, J. O. Crabtree, and I. L. Feld. March 1972. 24 pages.

PB–209 012

Although fluidized beds have been used extensively in the chemical processing industry since 1921, it is only in more recent years that they found application in the iron and steel industry. It has now been found that gaseous direct reduction of low-grade iron ores a high-metallic fluid-bed product. Magnetic concentration of this product can produce a high-grade metallized concentrate, which can be agglomerated to produce a suitable cupola feed. The concentrate would also be a potential electric furnace feed if blended with other metallic materials. This document describes the process and gives the optimum process parameters.

ELECTROSTATIC SEPARATION WITH PHOTOELECTRIC CHARGING

Bureau of Mines, College Park Metallurgy Research Center. Foster Fraas. March 1972. 20 pages.

PB–209 013

Electrostatic separation of minerals is used when froth flotation fails, where there are similarities in response with magnetic and gravitational methods, or when the use of water is to be avoided. In practice this method is confined to sand-sized particles. Finer particles not only remain unseparated, but also contribute to a dust hazard and nuisance factor. A possible solution to this problem, describes for the first time in this report, involves the use of an ultraviolet lamp to produce electric charges on the mineral particles by the photoemission of electrons. It appears that many of the oxides, carbonates, sulfides, and arsenides will respond to the method. That the separation can be carried out in air and without the use of reagents or heating, which are required in electrostatic separation methods in common use, is of special significance.

FLASH REDUCTION OF IRON ORE

Bureau of Mines, Tuscaloosa Metallurgy Research Laboratory. E. G. Davis, and I. L. Feld. April 1972. 15 pages.

PB–209 541

The treatment of low grade iron ores to remove oxygen has received considerable attention in recent years, particularly the method of reduction roasting. As in all the methods used, the effective treatment of fine particles is a problem. The present in-

Beneficiation and Refining
(continued)

vestigation is concerned with using a flash type reactor in which the fine iron ore is entrained and pneumatically transported through the reactor at the desired temperature, and flash reduced in a very short period of time. The report covers the construction and performance of a coil reactor with hydrogen and oxygen-reformed natural gas as the reductants. Two types of products were obtained, one by metallizing in which metallic iron was produced, the other by magnetizing in which magnetic iron oxide resulted. A statistical analysis is given of both methods.

RECOVERY OF COPPER FROM CONVERTER SLAGS BY FLOTATION

Bureau of Mines, Salt Lake City Metallurgy Research Center. V. E. Edlund, and S. J. Hussey. 1972. 17 pages.

PB–210 744

Most of the world's output of copper is produced by smelting copper sulfide concentrates in reverberatory furnaces, followed by oxidation to blister copper in a converter. Slags produced in the converter are too high in copper to discard, and so are returned to the reverberatory furnace to recover most of the copper. This procedure complicates the operation of the reverberatory furnace and contributes significantly to loss of copper in the reverberatory slag. Flotation appears to be the most economical alternative method of recovery of copper from slags. This document describes flotation and grindability tests on converter slags containing from 1.6 to 6.6 percent copper. The relative merits and costs for the flotation of slow-cooled versus water-quenched slags were determined. In general, it was found that the higher copper recover for slow-cooled slags would offset the higher processing costs for treating this type of slag. This report supersedes PB-204 133, which is described in the July 1972 issue of AMTID, page 1.

Chemical Analysis

FIELD IDENTIFICATION OF WEATHERED PAINTS

Naval Civil Engineering Laboratory. H. P. Vind, and R. W. Drisko. April 1972. 23 pages.

AD–743 870

There are a number of situations where identifying the general type or general composition of weathered paints would be helpful. For example, it might be desirable to determine the compatibility of weathered paint with a proposed topcoat; or it may be necessary to determine the cause of premature paint failure or to verify that a specified paint was used. This document describes a simple procedure for identifying the generic type and general composition of cured or weathered paint films. The procedure includes pyrolytic and burning tests, solubility tests, and tests for the detection of such elements chlorine, nitrogen, lead, and mercury. All the tests can be performed with simple equipment by field personnel having little or no laboratory experience.

GAS CHROMATOGRAPHIC DETERMINATION OF WATER IN PAINT SOLVENTS, PAINT REMOVERS, AND BRAKE FLUIDS USING POROUS POLYMER COLUMN PACKING

Aberdeen Research and Development Center (U.S. Army), Coating and Chemical Laboratory. George G. Esposito. May 1972. 19 pages.

AD–746 608

In paint and related industries, as well as many other areas, it is often necessary to know the water content of a given product. Gas chromatography is the ideal technique for the determination of most volatile compounds, but erratic results are had with existing methods when attempts are made to determine water in different systems. This report describes a general, rapid, and accurate gas chromatographic technique for the determination of water which uses a chromatographic column prepared from porous polymer packing. Application of the technique is demonstrated with products of different composition; namely, paint solvents, paint strippers, and brake fluids. The method should be amenable to the analysis of other materials, such as petroleum products and cleaning compounds.

IMPROVED CHEMICAL METHODS FOR SAMPLING AND ANALYSIS OF GASEOUS POLLUTANTS FROM COMBUSTION OF FOSSIL FUELS.
VOLUME I: SULFUR OXIDES

Walden Research Corporation. J. N. Driscoll, and A. W. Berger. July 1971. 261 pages.

PB–209 267

IMPROVED CHEMICAL METHODS FOR SAMPLING AND ANALYSIS OF GASEOUS POLLUTANTS FROM COMBUSTION OF FOSSIL FUELS.
VOLUME II: NITROGEN OXIDES

Walden Research Corporation. J. N. Driscoll, and A. W. Berger. July 1971. 173 pages.

PB–209 268

IMPROVED CHEMICAL METHODS FOR SAMPLING AND ANALYSIS OF GASEOUS POLLUTANTS FROM COMBUSTION OF FOSSIL FUELS.
VOLUME III: CARBON MONOXIDE

Walden Research Corporation. J. N. Driscoll, and A. W. Berger. July 1971. 72 pages.

PB–209 269

This series of documents provides the results of a literature search and a review of methodologies for the sampling and analysis of the most common gaseous effluents from stationary fossil fuel combustion sources. Volume I examines manual (i.e., wet chemical) methods for sulfur dioxide and sulfur trioxide from emission sources both with and without pollution control equipment installed. In addition, the general principles of flue gas sampling are discussed. Volume II reviews methods for the determination of oxides of nitrogen for the concentration range 5-2000 ppm for nitric oxide, nitrogen dioxide, and total oxides of nitrogen. Volume III examines state-of-the-art manual methods for sampling and analysis of carbon monoxide for the concentration range 10-1000 ppm.

THE ANALYSIS OF AROMATIC COMPOUNDS IN WATER USING FLUORESCENCE AND PHOSPHORESCENCE

University of New Hampshire, Water Resources Research Center. David W. Ellis. June 1972. 79 pages.

PB–212 268

The presence of small amounts of polynuclear aromatic hydrocarbons (PNA) in many areas of the environment has focused attention on the development of improved analytical measurements for their determination. Much of this interest can be attributed to the fact that a substantial number of PNA have been shown to be highly carcinogenic. The major source of PNA in the environment is the incomplete combustion of coal and other fuels. However, there is sufficient evidence to demonstrate that trace amounts of PNA are synthesized by naturally occurring organisms. This report describes a method for the determination of trace amounts of PNA in natural water. The analytical scheme used includes: Continuous liquid-liquid extraction of 5 liters of water with n-pentane followed by concentration of the extract to several milliliters; removal of interfering substances; thin-layer chromatography (TLC) of the concentrated eluent to separate the individual PNA; and quantitative fluorescence analysis of the separated compounds. A gas chromatographic-mass spectrographic technique is also discussed.

Desalination

INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE—7

Oak Ridge National Laboratory, Nuclear Desalination Information Center. K. O. Johnsson. September 1972. 73 pages.

ORNL–NDIC–13

This bibliography contains abstracts of approximately 200 published articles and reports related to the desalination of seawater. The following general subject areas are covered: Energy sources, coupling of an energy source to a desalting plant, seawater distillation processes, desalting processes other than distillation, overall plant studies, plant site considerations, industrial applications, domestic and industrial consumption of desalted water, and use of desalted water in agriculture. An author and a subject index are included. The three previous issues of this bibliography are described in the July 1972 issue of AMTID, pages 4 and 5.

BIBLIOGRAPHY OF SALINE WATER CONVERSION LITERATURE

Rocketdyne Division of North American Aviation, Incorporated. J. J. Schamus. September 1965. 380 pages.

PB–209 260

This bibliography represents the first attempt to prepare a comprehensive bibliography of the desalination literature, and is considered to contain a fairly complete listing of works on the subject published through approximately mid-1965. It provides 6120 references arranged according to slightly more than 400 subject categories. Also included are an author index keyed to the subject categories, and a cross-index of subjects.

DESALTING

National Water Commission, Engineering and Environmental Division. Victor A. Koelzer. May 1972. 133 pages.

PB–209 942

After 20 years of research, the mechanics of the most important water desalting processes are reasonably well understood. Worldwide use is shifting from rare and experimental situations to fairly extensive use in small-sized plants. This report provides a state-of-the-art evaluation of desalting technology as a means of increasing water supply. A historical review of desalting research is followed by a summary of the present status of the various desalting technologies. Considerable emphasis is given to costs of the various processes, and an attempt is made to assess potential markets. Possible effects of desalting on the environment is also considered.

A METHOD OF DEMINERALIZATION USING STRONGLY BASIC ION EXCHANGE RESINS

New Mexico State University, Department of Civil Engineering. William S. Midkiff. August 1972. 57 pages.

PB–212 272

A new approach to demineralization of marginally brackish waters for individual domestic use has been proposed. An engineering evaluation of the use of various cation exchange resins is given. Primarily the report presents the test results from various commercial resins. The investigation suggests that partial demineralization using a weak acid—weak base iron exchange system should offer simplicity and economy. In order to be satisfactory for domestic use, water need not be completely demineralized, however, in many cases it is desirable to provide more extensive treatment

Desalination
(continued)

than hardness removal by sodium exchange. Regeneration characteristics must be favorable for the system to be economical. A system composed of a weakly acidic ion exchange column in hydrogen ion form and a weakly basic ion exchange column in hydroxide ion form will remove an increment of multivalent anions and cations and replace them with an equivalent amount of water.

Inorganic Chemicals

CdS CRYSTALS

Defense Documentation Center. May 1972. 534 pages.

AD–742 200

This bibliography is comprised of abstracts of reports of U.S. Government-funded research on monocrystalline cadmium sulfide. The entire range of research on this substance is covered, including crystal growth, physical properties, uses and limitations in semiconductors, and electronic interactions and configurations. Indexes are included. The reports listed, which were all published during the time period 1961-1971, are available from NTIS.

SOLID STATE CHEMISTRY

National Bureau of Standards, Institute for Materials Research. R. S. Roth, and S. J. Schneider (Editors). July 1972. 799 pages.

COM–72–50746

This book contains 63 papers prepared for the 5th Materials Research Symposium, held at the National Bureau of Standards, 18–21 October 1971. The purpose of the symposium was to explore the realm of new inorganic materials, emphasizing crystal-chemical and structural aspects, thus providing a forum for discussion of new research problems and techniques. The materials of primary interest were oxides, chalcogenides, borides, carbides, silicides and similar compounds. The papers are primarily on current research, although some reviews are also included.

CARBON-13: A SELECTED ABSTRACT BIBLIOGRAPHY

Monsanto Research Corporation, Mound Laboratory. W. S. Stringham. May 1972. 206 pages.

MLM–1913

Interest in the stable carbon isotopes has increased considerably in the last several years. One of these, carbon-13, has been available commercially for several years at enrichments up to about 55%. This bibliography was prepared for the purpose of helping the development of applications of carbon-13. It contains references and abstracts of articles and reports published from 1962 through 1971. Emphasis is placed on materials which describe production processes, analytical methods, and investigative or clinical tools. Author and subject indexes are included.

* * *

THE RADIOCHEMISTRY OF THE RARE GASES

National Academy of Sciences—National Research Council, Subcommittee on Radiochemistry. Floyd F. Momyer, Jr. 1971 (reissue of 1960 edition). 63 pages.

NAS–NS–3025

A compilation is provided of radiochemical information and procedures concerning the rare gases (helium, neon, argon, krypton, xenon, and radon). The first portions of the monograph are devoted to general reviews of rare gas properties of interest to the radiochemist, and to some general discussions of separation techniques for rare gases. The remaining parts discuss the removal of rare gases from targets, discuss techniques used for counting radioactive rare gases, and give a collection of radiochemical procedures for rare gases.

* * *

THE CHEMISTRY OF GYPSUM AND ITS DEHYDRATION PRODUCTS. VOLUME I: THE PHASES AND THEIR STABILITY AND SOLUBILITY. PART 5: SUPPLEMENT

Stanley Evan Edinger. August 1972. 247 pages.

PB–211 207

This document is one part of a five-part annotated bibliography on he phases of gypsum. It contains references and abstracts which upplement and up-date the first four parts; a list of dictionaries and grammars useful in translating technical articles into English; general reference works; technical reference works; library and literature guides; list of libraries, government organizations, and pubishers from whom many of the articles cited can be obtained; abstracting journals and literature indexes; and an author index o Parts 1–5. Parts 1 and 2 of this Volume are described in the April 1972 issue of AMTID, page 11; Parts 3 and 4 are described n the October 1972 issue, page 6.

* * *

Process Engineering

DEVELOPMENT OF BATCH CONTROL TECHNIQUES FOR SYNTHETIC LUBRICANTS

IT Research Institute. Eli S. Freeman, and Winfried K. Rudloff. February 1970. 64 pages.

AD–866 489

A method for batch-to-batch control during the production of synhetic lubricants was developed and is described in this report. The method involves differential thermal analysis, although hermogravimetric analysis and derivative thermogravimetric anlysis also appear to be suitable for the purpose. Also, results are iven for an investigation of thermal degradation processes of everal selected lubricants and their basestocks.

* * *

ENGINEERING ANALYSIS OF THE ROTOFERMENTOR

University of California, Department of Chemical Engineering and Lawrence Berkeley Laboratory. Argyrios Margaritis, and Charles R. Wilke. August 1971. 46 pages.

LBL–222

The Rotorfermentor is a relatively new type of fermentation apparatus which is designed to achieve high cell densities in batch and continuous cultures by removal of toxic metabolic end products continuously through a rotating filtration membrane. Possible applications include the production of vaccines, antibiotics such as penicillin, endoenzymes, proteins, nucleic acids, vitamins, etc. This paper presents an engineering analysis which reviews basic theoretical principles of the Rotorfermentor design and operating characteristics. Equations are given which yield filtration rates and power consumption. In addition, an equation is presented which relates cell productivity per unit fermentor volume of the Rotorfermentor with that of an ordinary fermentor. Performance of the Rotorfermentor is also compared with that for a membrane dialysis fermentor system.

DEVELOPMENT OF THE CATALYTIC CHAMBER PROCESS FOR THE MANUFACTURE OF SULFURIC AND NITRIC ACIDS FROM WASTE FLUE GASES

Tyco Laboratories, Incorporated. B. Keilin, and A. L. Walitt. September 1969. 181 pages.

PB–209 191

The primary offending pollutant in power plant stack gases is sulfur dioxide, although the nitrogen oxides present are also considered detrimental to human, plant, and animal life. A new process is described in this report which permits the recovery of the sulfur values of these stack gases as sulfuric acid and which requires no investment in raw materials. Essentially, the process utilizes the nitrogen oxides already present in the gases as a catalyst to oxidize the sulfur dioxide to sulfuric acid. The nitrogen oxides are then reoxidized, with the excess nitrogen dioxide being converted to nitric acid and the bulk of the oxide recycled for further sulfur dioxide oxidation. The process requires no heat input beyond that normally present in stack gases. It is possible for the process to not only recover the costs of pollutant removal, but to also yield a profit through the sale of the product acids. In addition, the process may provide an alternative to currently used methods of manufacturing sulfuric acid from conventional sources of sulfur dioxide.

USE OF PREHEATED COAL IN CARBONIZATION

Bureau of Mines, Pittsburgh Energy Research Center. D. E. Wolfson. April 1972. 13 pages.

PB–209 543

Increased concern for protection of the environment is stimulating efforts about the world to deal with emission problems associated with coke production. The preheating of coal before carbonization has proved advantageous in this direction, and overcoming some difficulties and hazards associated with charging hot dry coal to an oven is expected to increase the oven capacity, eliminate smoke, decrease the coking time, and improve the economy of the carbonization process. The report covers the use of superheated steam, which minimizes fire and explosion hazards; resistor-type electric furnaces; and a 60-foot helical coil of 1-inch stainless steel. Design, temperature, and coal property data are given, along with a statistical analysis of the carbonization products and time, and a discussion of yield and quality control.

—o—

PHOTOELECTRIC CONCENTRATOR FOR THE WET CONCENTRATING TABLE

Bureau of Mines, Pittsburgh Energy Research Center. R. A. Welsh, and A. W. Deurbrouck. April 1972. 12 pages.

PB–209 545

Research on the desulfurization of coal by physical means includes the production of a pyrite concentrate that can be sold as a by-product. The difficulty has lain in sensing the differences in the pyrite mixtures between acceptable concentrates and those containing unacceptable proportions of impurities and shale. The wet table, or visual inspection board, equipped with photoelectric sensors provides a means of determining the division of the pyrite mixtures. A description is given of an apparatus which can sense small differences in the color between concentrated pyrite and unacceptable products, located at the approximate dividing line between the pyrite concentrate zone and the nonconcentrate zone. Test procedures and results are described, and a summary is given of data for a particular coal size.

—o—

MAGNESIUM CARBONATE, A RECYCLED COAGULANT FOR WATER TREATMENT

Department of Public Utilities, City of Gainsville (Florida). June 1971. 116 pages.

PB–209 938

Iron and particularly aluminum salts (Alums) have served well in the coagulation and clarification of water. However their highly hydrated and gelatinous property makes dewatering and disposal of the sludge produced extremely difficult and costly. Because of this solid waste disposal problem, an entirely new system has been developed utilizing magnesium carbonate as the coagulant. The

Process Engineering (continued)

addition of sufficient lime slurry to water containing magnesium bicarbonate to which magnesium carbonate has been added, precipitates both magnesium hydroxide and calcium carbonate. Chemical treatment costs for most waters can be substantially reduced using this system, while the quality of treated water will be superior to the quality of alum-treated water.

Waste Processing and Materials Recovery

DISPOSAL OF FLUORINE AT LOW CONCENTRATIONS

Union Carbide Corporation. H. Pulley, and R. L. Harris. April 1972. 14 pages.

KY–638

The safe disposal of waste gases containing elemental fluorine is a common problem among industries using this very reactive and toxic material. The simplest and most economical method thus far developed appears to be one based on the reaction of wood charcoal with chlorine to produce gases which can be safely vented to the atmosphere. However, an explosive reaction is occasionally observed with this method, and its utility with low fluorine concentrations has been unknown. This report describes a modification of the charcoal method which eliminates the explosion hazard and which permits the efficient conversion of fluorine in concentrations as low as 0.1% to nontoxic fluorocarbons.

RECOVERY OF ALUMINUM, BASE, AND PRECIOUS METALS FROM ELECTRONIC SCRAP

Bureau of Mines, Boulder City Metallurgy Research Laboratory. T. A. Sullivan, R. L. de Beauchamp, and E. L. Singleton. March 1972. 21 pages.

PB–209 015

Obsolete and irreparably damaged electronic equipment represent a potential source of valuable metals. Components of this equipment often have copper pins, contacts, and connectors that are plated with silver, gold, or other metals. Generally, these components are contained in aluminum cases. Two molten-salt electrorefining processes have now been developed which are suitable for treating scrap electronic equipment to recover aluminum as a high-purity product and to concentrate the majority of metal values in a form that can be recovered by commercial smelting and electrorefining techniques. One method uses a three layer refining cell to produce aluminum of 99.8% purity, and the second method uses a cell with separate anode and cathode compartments to effect the recovery of an aluminum product of 99.6% purity. Both methods recover about 94% of the aluminum in the scrap and resulted in a three-fold concentration of other metallic values in the anode residue. Details of the processes are given in the report.

SYSTEMS EVALUATION OF REFUSE AS A LOW SULFUR FUEL. VOLUME I

Envirogenics Company; Foster Wheeler Corporation; and Cottrell Environmental Systems, Incorporated. R. M. Roberts, R. E. Sommerlad, A. P. Konopka, et al. November 1971. 311 pages.

PB–209 271

SYSTEMS EVALUATION OF REFUSE AS A LOW SULFUR FUEL. VOLUME II

Envirogenics Company; Foster Wheeler Corporation; and Cottrell Environmental Systems, Incorporated. R. M. Roberts, R. E. Sommerlad, A. P. Konopka, et al. November 1971. 301 pages.

PB–209 272

Boilers fired by refuse, or by a combination of refuse and fossil fuel, hold promise in alleviating problems involving the disposal of solid wastes and also those involving the pollution of the atmosphere through the burning of low-cost fuels with high sulfur contents. This report provides the results of a program which was undertaken to determine the characteristics of systems, that would be optimal in terms of the state-of-the-art technology, for using refuse as a low-sulfur fuel for power generation. Consideration was also given to the overall potential of using such systems to decrease the total emissions from the incineration of refuse, and to assist in reducing sulfur pollution now resulting from fossil fuel combustion. The topics covered in Volume I include: Refuse as a fuel (quantities available, combustion and interactions, potential pollutant reductions, handling and processing, energy utilization); power plant design considerations (catalog of candidate systems, evaluation of selected engineering designs); and recommendations (immediate technological opportunities, suggested research and development plans). Volume II is comprised of appendices for use with Volume I, including a state-of-the-art survey and a fairly extensive bibliography.

◆

TECHNICAL AND ECONOMIC FACTORS ASSOCIATED WITH FLY ASH UTILIZATION

Aerospace Corporation. July 1971. 271 pages.

PB–209 480

Fly ash is the particulate residue produced from burning pulverized coal. Potential uses for fly ash include concrete (including lightweight "gas" concrete), lightweight aggregate, portland cement manufacturing, bricks, bituminous filler, road construction, land fill, and mineral wool. In spite of the fact that large amounts of fly ash are produced, particularly by the electric power industry, very little of it is used in these applications. This report provides a survey of fly ash production, utilization, economics, specifications, and properties. Particular attention is given to current use inhibitions and possible measures which may improve the fly ash market. Consideration is also given to the properties and potential uses of limestone-modified fly ash, which is now being produced by some plants which use wet limestone scrubbing as an anti-pollution measure. A fairly comprehensive bibliography is included.

WASTE TREATMENT LAGOONS—STATE-OF-THE-ART

Missouri Basin Engineering Health Council. July 1971. 156 pages.

PB–209 937

Although waste treatment lagoons were first used in the mid-twenties, it was not until the last two decades that waste treatment lagoons achieved popularity. In spite of their widespread use, there are limited data as to the operational characteristics of waste treatment lagoons. The purpose of this state-of-the-art review is to bring together as much information as is available about them and to develop sound design and operational criteria. For convenience, the review breaks down the lagoons into three types: oxidation ponds; aerated lagoons; and anaerobic lagoons.

LIQUID WASTES FROM CANNING AND FREEZING FRUITS AND VEGETABLES

National Canners Association, Western Research Laboratory. Walter A. Mercer, Walter W. Rose, and Kenneth W. Weckel. August 1971. 164 pages.

PB–209 941

The effective minimizing of the pollutional loads in fruit and vegetable processing is becoming important to both the economic and social status of the industry. This document consolidates and makes available the substance and record of published information dealing with wastes generation during fruit and vegetable processing. Also, it seeks to direct attention to potential areas for reducing loads through research, most of which will have economic advantages to the operation. Specific topics covered include: Harvest and delivery; processing operations and water use; waste generation and characteristics; treatment and disposal methods for solid and liquid waste; costs of liquid waste treatment and disposal; research needs. A bibliography of over 700 entries is included.

RECOVERY OF ZINC, COPPER, AND LEAD-TIN MIXTURES FROM BRASS SMELTER FLUE DUSTS

Bureau of Mines, Rolla Metallurgy Research Center. H. E. Powell, H. Fukubayashi, L. W. Higley, and L. L. Smith. 1972. 12 pages.

PB–210 190

A survey of several brass smelters utilizing dust-collecting equipment revealed that they were collecting 1 to 2 tons per day. Usually this is discarded as waste. No practical processes have existed for recovering metal values from brass smelter flue dusts. This document provides details of a newly developed process for recovering zinc, copper, and lead (also tin, if present) from these dusts. It is an onsite, batch operation, and there is a bulk separation of the lead and tin from the zinc and copper. The zinc can be processed as zinc sulfate (which, in some areas, is readily salable as an agricultural product) or as electrolytic zinc. The lead-tin residue can be sold for recovery by conventional methods.

ANAEROBIC TREATMENT OF SYNTHETIC ORGANIC WASTES

Union Carbide Corporation, Chemicals and Plastics Division. J. C. Hovious, J. A. Fisher, and R. A. Conway. January 1972. 205 pages.

PB–211 130

The only practical tools now available for treating soluble organics in large volumes of wastewater from a petrochemical plant are the aerobic biological systems. This report describes a study of anaerobic systems which was undertaken to provide design engineers with an alternative approach potentially avoiding some of the problems characteristic in aerobic treatment and offering some performance improvements and economic advantages. It was found that, in warm, spacious locations, anaerobic lagooning, is an economical, effective processes for pretreating petrochemical wastes prior to aerobic stabilization. A description is given of a demonstration plant, and results are provided of pilot studies and an economic analysis of the system.

BIOLOGICAL CONCEPTS FOR DESIGN AND OPERATION OF THE ACTIVATED SLUDGE PROCESS

Oklahoma State University, BioEnvironmental Engineering Laboratories. Anthony F. Gaudy, and Elizabeth T. Gaudy. September 1971. 156 pages.

PB–211 131

The activated sludge process has been increasingly employed for secondary treatment of municipal and industrial wastes containing significant amounts of organic material. Its chief distinguishing characteristic is that the heterogeneous microbial populations, of which the sludge is largely composed, are grown in fluidized culture with provision for maintenance of the organisms in suspension by turbulent mixing and for introduction into solution of sufficient oxygen for the respiratory requirements of the microorganisms. This report presents available biological concepts, applicable to the design and operation of activated sludge processes, in terms readily understood by engineering professionals. The topics covered include: Measurement of purification; fundamental stoichiometry of biological treatment; kinetics of microbial growth; kinetics of completely mixed reactors; factors tending to disrupt the steady state-shock loadings; process modifications for nitrogen-deficient wastes; extended aeration process; and some recommendations for design and operational procedures.

* * *

SOLID WASTE: A NEW NATURAL RESOURCE

West Virginia University, Department of Chemical Engineering. May 1971. 18 pages.

PB–211 256

This report deals with the prospects of converting solid municipal wastes to fuels. Particular attention is given to a process under development which involves the pyrolysis of such wastes using a fluidized bed gasifier. The product is a gas of high thermal efficiency which may be used directly as a fuel, may serve as a source of methane, or may be used as a raw material in organic synthesis and in the mineral and metallurgical industries. The basic process is explained, and descriptions and flow sheets are provided for proposed municipal-scale plants.

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NITROGEN REMOVAL FROM WASTEWATER

Federal Water Quality Administration, Advanced Waste Treatment Research Laboratory. Robert B. Dean (Editor). October 1970. 32 pages.

PB–212 280

Classically, sewage treatment has been directed toward the removal of suspended solids, biochemical oxygen demand, and reduction of bacterial contaminants. Removal of nutrients such as phosphorus and nitrogen has been incidental to treatment process. The recognition of the important role of these substances in the pollution problem, however, has focused attention in recent years on nutrient control from municipal sources. This report provides a state-of-the-knowledge review of nitrogen removal, as presented in seven short papers. The topics covered include: A statement of the problem of nitrogen removal from wastewaters; nitrogen removal by biological suspended growth reactors; nitrogen removal by column reactors; ammonial nitrogen removal by stripping with air; removal of ammonia nitrogen by selective ion exchange; ion exchange for nitrate removal; other methods for removing nitrogen. This document supersedes an earlier one of the same title (PB–206 306), which was described in the July 1972 issue of AMTID, page 15.

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RADIOACTIVE WASTE PROCESSING AND DISPOSAL

U.S. Atomic Energy Commission, Technical Information Center. April 1972. 596 pages.

TID–3311 (Suppl. 3)

is document is a bibliography comprised of 2,249 annotated erences to publications concerning radioactive waste processing d disposal, most of which were published during the years 1966–71. Corporate author, personal author, report number, and oject indexes are included. The publications cited are all publicly ailable, either through scientific and technical journals or ough NTIS.

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)MPLETE RE-USE OF TEXTILE DYEING ASTES PROCESSED WITH DYNAMIC MEMBRANE (PERFILTRATION

k Ridge National Laboratory (AEC). C. A. Brandon, J. S. nson, R. E. Minturn, and J. J. Porter. 1971. 18 pages.

D–25863

has been found that hyperfiltration, or reverse osmosis, can nove more than 85% of the organic carbon content from the uent of a synthetic upholstry dyeing operation. Both purified duct and concentrated residue from the treatment have been ectly reused in critical dyeings. Because this method permits ste water to be treated at process temperatures, it is also pos-e to reuse the hot water. Thus, the employment of hyperfiltra-ı in textile waste treatment offers a definite possibility for rly complete reuse. The document provides a description of the cess and gives the results of dye reuse studies.

* * *

MATERIALS

Ceramics and Glass

THE SCIENCE OF CERAMIC MACHINING AND SURFACE FINISHING

American Ceramic Society; Naval Research Laboratory; and National Bureau of Standards. S. J. Schneider, Jr., and R. W. Rice (Editors). May 1972. 413 pages.

COM–72-50763

The machining and machining process is of fundamental importance to the manufacture of many commercial ceramic products. Ultimate success and reliability often lies with the nature of machining variables. In view of this, a symposium was held at the National Bureau of Standards, 2–4 November 1970, to survey the developing science of ceramic machining and to stimulate further progress by discussion of current problems and research. This document is comprised of 37 review and original research papers presented at the symposium. Four main subject areas are covered: Techniques and mechanisms of removal and shaping; surface treatment; analysis and characterization of machining effects; and mechanical and other effects of machining.

A FUNDAMENTAL REVIEW OF THE FRICTION AND WEAR BEHAVIOR OF CERAMICS

National Aeronautics and Space Administration, Lewis Research Center. Donald H. Buckley. 1972. 30 pages.

N72–23582

The greatest amount of effort in fundamental studies of adhesion, friction, and wear has been put into metals. In recent years, however, the increasing potential for the use of ceramics as components in lubrication systems has focused attention upon these materials. This document provides a review of the adhesion, friction, and wear of ceramics, anisotropic friction and wear behavior, and the effect of surface films and metal-ceramic interactions. Anologies to metals are made where applicable. Both ceramics and other ionic solids are discussed.

PROCEEDINGS OF THE SECOND ANNUAL SYMPOSIUM ON REDUCTION OF COSTS IN HAND-OPERATED GLASS PLANTS

West Virginia University, Engineering Experiment Station. R. P. Smith (Editor). March 1972. 78 pages.

PB–211 118

These proceedings contain the papers read at the symposium, which was held in Clarksburg, West Virginia, 26–28 May 1971. Their subject matter includes: A review of factors affecting corro-

Ceramics and Glass
(continued)

sion of refractories; avoiding common mistakes in selection and application of refractories for glass melters; possible operating cost reductions through raw material handling; ideas from Europe in the mechanization of hand-operated glass plants and processing equipment; methods of efficient fuel utilization; use of semi-automatic machines in hand-operated glass production lines. Also included is a transcript of a discussion on the general subject of the design and operation of a modern hand-operated glass plant. The proceedings of the first symposium in this series is available as PB–196 138 (see AMTID January 1972, page 11).

Composite Materials

FABRICATION OF NOVEL COMPOSITES. PART I: REACTIVE HOT PRESSING OF GAMMA-Al^{2}O^3 WITH SYNTHETIC FLUORINE MICAS

Army Materials and Mechanics Research Center, Ceramics Division. February 1972. 22 pages.

AD–742 207

Most ceramic materials exhibit many desirable properties, but are extremely brittle and difficult to machine by routine methods. Hence, various investigators have been studying the possibility of incorporating ductile or flexible components into ceramics to moderate the brittle characteristics. A unique family of materials which have been overlooked as candidates for such uses are micas, especially high-melting synthetic fluorine micas. It has now been demonstrated that mica may be utilized as a component in composites in combination with ceramics. By properly choosing the matrix material, such composites can be tailor-made for specific applications simply by adjusting the chemical composition of the mica. For example, in K- and Ba-mica/Al^{2}O^3 composites, flexure strengths from 25,000 to 45,000 psi and elestic moduli from 28 to 50 x 10_6 psi were measured.

COMPOSITE MATERIALS

North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Revelopment. B. W. Rosen, R. J. Diefendorf, B. E. Read, I. C. Taig, and M. E. Waddoups. May 1972. 119 pages.

AD–744 596

This document is comprised of a series of seven papers which are intended to provide an up-to-date review of the procedures for utilization of some of the newer composite structural materials. After a review of materials (fibers, reinforced plastics, metal matrix composites), their physical properties, and strength, the fabrication methods for the materials are presented. A presentation is then given of experimental methods, analytical methods, automated design, and future trends. Finally, general considerations of the application of new composites and airframe applications of composites are given.

BIBLIOGRAPHY ON FIBERS AND COMPOSITE MATERIALS—1969–1972

Battelle Columbus Laboratories, Metals and Ceramics Information Center. J. N. Fleck. July 1962. 103 pages.

AD–746 214

This bibliography contains over 3,000 references to the world's literature pertaining to fibrous composite materials and fibers suitable for use in them. The types of composites covered includes those with resin, ceramic, carbon, and metal matrixes; and the fibers covered include asbestos, boron, carbon/graphite, boron carbide, glass, fused silica, polycrystalline oxides, sapphire, silicon carbide, silicon nitride, and metallic. The entries are arranged according to material.

STIFFNESS OF NON-ALIGNED FIBER REINFORCED COMPOSITES

Monsanto Research Corporation. R. E. Lavengood, and L. A. Goettler. May 1971. 55 pages.

AD–886 372

The expanding use of sheet and bulk molding compounds has increased the need for reliable techniques for predicting the stiffness of composites reinforced with short fibers. Means are known for estimating the elastic properties of composites in which the fibers are aligned uniformly at some angle to the direction of stress. However, this is an artificial situation for short fibers, which cannot easily be put into a high degree of alignment. Instead, practical moldings usually contain a wide distribution of fiber orientation angles. This paper discusses a general procedure for predicting the average Young's modulus of short-fiber composites. Nonuniform, as well as random, fiber distributions are considered. Comparison of various predictions with the measured moduli of epoxy composites indicates the technique is acceptable.

A REVIEW OF PROPERTIES OF POLYMER IMPREGNATED CONCRETE

Brookhaven National Laboratory (AEC). Allan Auskern. January 1972. 48 pages.

BNL–16578

Incorporating a relatively small amount of a polymer in cured concrete or mortar alters the nature of the original material dramatically. A new and different structural material results with properties only remotely related to the starting materials. This material, generally called polymer impregnated concrete, has been the subject of a fairly intensive research program since its discovery in 1968. This report reviews some of the important properties of polymer impregnated concrete, and discusses factors affecting its properties. Also, techniques for producing the materials are outlined, and their potentials and limitations are briefly explored.

THEORY OF FIBER REINFORCED MATERIALS

University of Pennsylvania. Zvi Hashin. March 1972. 705 pages.

N72–21932

From the engineering point of view the most important type of composite materials at the present time are fiber reinforced materials (FRM). If the engineer is to use these materials with confidence, he must have detailed and reliable knowledge of their physical properties. Due to the very large number of variables involved in FRM, however, an experimental program to characterize the physical properties would involve an enormous number of experiments. A more hopeful approach is to construct a theory of FRM whose predictions shall have to be verified by experiment. Such a theory would permit the determination of the properties of materials in use and, more important, would function as a guide to the design of materials with required properties, which is the ultimate goal of materials engineering. It is the purpose of this report to present such a theory. The areas covered include the geometry of FRM, elastic analysis, viscoelastic static and dynamic properties, thermal and electrical conduction, dielectrics, magnetics, theory of thermoelastic behavior, and strength prediction.

DESIGN CONSIDERATIONS FOR FIBER COMPOSITE STRUCTURES

National Aeronautics and Space Administration, Lewis Researc
Center. C. C. Chamis. 1972. 33 pages.

N72–23918

Structures of fiber composites are of light weight and are amenable to modular and complex shape. These characteristics mak them primary material contenders in applications where ease o construction, remodeling, dismantling, and/or transportation ar important design considerations. This document presents a synopsis of the design methodology available in designing structura components from fiber composites. The general design concept sources and types of design data, analysis methods and thei capabilities, and design procedures are described. Illustrations o basic structural components and shapes are given. Types of joint parametric designs, and optimum designs are discussed, and simple three-dimensional truss is described in some detail. Emphasis is placed on possible applications to residential, commercia and industrial structures.

Composite Materials
(continued)

ITERATURE SURVEY OF THE FIELD OF IBER-REINFORCED PLASTIC COMPOSITES: ART I (1958-AUGUST 1970)

exas A and M University, Materials Engineering and Materials cience Division. S. W. Beckwith, R. A. Schapery, and L. D. ebb. September 1970. 251 pages.

B–210 304

ITERATURE SURVEY OF THE FIELD OF IBER-REINFORCED PLASTIC COMPOSITES: ART II (AUGUST 1970-JULY 1971)

exas A and M University, Materials Engineering and Materials cience Division. S. W. Beckwith, R. A. Shapery, and L. D. Webb. ugust 1971. 93 pages.

B–210 305

hese publications provide an in-depth survey of the literature ealing with fiber-reinforced plastic composites. Part I contains pproximately 1,950 abstracts of relevant references and Part II as about 500 abstracts. Coverage is given of the mechanical, ermal, and optical characterization of fiber-reinforced plastics, well as the analytical methods used to predict laminate be- vior. The area of failure and the influence of physico-chemical fects on mechanical behavior are also reviewed. Finally, sections design and application, materials and fabrication, and special st procedures are included. The abstracts are arranged accord- g to subject.

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Concrete
(Nonbituminous)

ACTORS WHICH INFLUENCE THE ETERIORATION OF CONCRETE IN DAMS AND EASURES FOR PREVENTION OF DETERIORATION

rmy Engineer Waterways Experiment Station. Bryant Mather. ctober 1966. 26 pages.

D–742 049

ncrete is said to have deteriorated when in time it has changed the extent that it is less than satisfactory for its intended pur- se. All concretes change with time, most improving during their rlier life history, and all reach a mechanical optimum after ich they decline. The objective of concrete technology is to oduce concrete at lowest initial cost that will not deteriorate thin the period it is needed. The report discusses the suscept- lity of concrete in dams to deterioration under certain condi- ns from specific causes, and suggests measures to prevent or ard such behavior during service life. Phenomena are noted ich contribute to concrete deterioration, including frost action regions subject to freezing and thawing, alkali-aggregate re- tions between cement and aggregate components, sulfate attack from ground and surface waters in arid regions, and oxidation or delayed hydration; all of which produce internal expansion. In addition, deterioration can result from contraction which produces cracks, and leaching in which solvents percolating through the concrete remove soluble constituents. Measures are discussed for dealing with all of these phenomena.

STRONGER CONCRETE

U.S. Army Engineer Waterways Experiment Station. Bryant Mather. October 1966. 60 pages.

AD–742 271

There are many factors that affect concrete strength and many ways of making concrete stronger. This document provides a review and discussion of these factors. Consideration is given to the influence of the characteristics of the cementing medium, characteristics of the aggregate, proportions of the paste, proportions of the concrete, the paste-aggregate interaction, mixing, consolidation, and curing on the compressive strength of concrete. Also included are discussions of methods of measuring concrete strength, some of the highest strengths obtained, applications, economics, and procurement.

RECYCLED CONCRETE

U.S. Army Waterways Experiment Station. A.D. Buck. May 1972. 40 pages.

AD–743 460

This report describes the results of tests which involved the use of crushed waste concrete in place of natural aggregates in concrete mixtures. The findings indicate that such concretes compare favorably in most respects with natural-aggregate concrete, except that the use of crushed concrete as a coarse aggregate results in somewhat lower strengths than control mixtures. Where this lower strength is not a problem, however, there are many reasons in favor of using crushed concrete pavements, or any other concrete not contaminated with sulfates, as concrete aggregates. This prospect is particularly attractive where natural aggregates are scarce or expensive, or where the disposal of concrete waste is a problem.

BUOYANT CONCRETE FOR OCEAN CONSTRUCTION AND FLOTATION

Naval Civil Engineering Laboratory. Harold M. Kusano. June 1972. 36 pages.

AD–744 922

Research on buoyant materials suitable for ocean construction has led to an investigation of flotable concrete, a material which would be especially advantageous in a sea water environment. The availability of concrete with densities below and approximate to that of seawater would make it possible to design surface, subsurface, and seafloor constructions which would otherwise be disregarded because of heavy dead loads, difficult handling, or high costs. The report covers experiments with buoyant concretes containing lightweight, non-absorbent glass nodules as the major aggregate constituent. Specimens from 35 different batches were tested for workability, strength, density, and absorption. The glass nodules were tested to implosion. Mix design curves and cost estimates were determined. Polymer impregnation was included; no waterproof coatings were used. A formulation is described which can be used as a low-cost buoyant filler material for ocean applications in which low strength is permissible.

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STUDY OF COMPOUNDS IN DUAL ROLE OF CURING AGENT AND PROTECTIVE TREATMENT OF CONCRETE

South Dakota Department of Highways. Helmer E. Everson, et al. January 1972. 23 pages.

PB–210 043

The introduction of coating compounds intended for the dual purpose of curing compounds and as a protective treatment from de-icing salts on Portland cement concrete created a need to information on the general effectiveness of these materials. Presented are results from tests which evaluated the use of these coating materials for highway concrete pavements. Two types of materials were used: chlorinated rubbers and linseed oil mixtures. The chlorinated rubbers were found to perform better than the others although they all were satisfactory. Wear appeared to be the limiting factor for the effective life.

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Corrosion and
Materials Degradation

EMBRITTLEMENT

Defense Documentation Center. May 1972. 141 pages.

AD–742 000

This bibliography is comprised of abstracts of reports resulting from U.S. Government funded research on the embrittlement of metals. The period covered is 1964 through 1971. Some of the topics dealt with are: Embrittlement of metals in the presence of water and organic liquids; thermal embrittlement of steels; liquid metal embrittlement; embrittlement of weld metals; irradiation embrittlement; stress-induced embrittlement; etc. Subject and title indexes are included. The reports listed are available from NTIS.

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SURVEILLANCE AND AUTOMATICALLY PROTECTION OF WATER TANK INTERIORS CONTROLLED SYSTEM FOR CATHODIC

Naval Civil Engineering Laboratory. Richard W. Drisko. April 1972. 24 pages.

AD–742 339

Cathodic protection is known to be an economical and effective method for preventing corrosion in the immersed interiors of steel water storage tanks. This document describes a system for installation in a cathodic protected water tank which allows for easy and rapid monitoring of tank-to-water potentials and which, in addition, insures that the immersed surfaces are receiving full protection from corrosion without excessive use of current. The system is essentially comprised of (1) a silver/silver chloride half cell permanently attached to the tank and which can be read at ground level with a portable meter, and (2) an automatically controlled rectifier used with the half-cell and existing anodes.

THE RESISTANCE OF SOME HIGH STRENGTH STEELS TO SLOW CRACK GROWTH IN SALT WATER

Navay Research Laboratory, Metallurgy Division. G. Sandoz. February 1972. 29 pages.

AD–744 944

Some data obtained on the stress corrosion cracking susceptibility of a number of steels in salt water are presented. It was found that the stress corrosion cracking resistance of steels generally increases as one progresses from the low allow steels to the high alloy steels, particularly at the higher levels of yield strength. There is no basis, however, for the choice of a particular class of high alloy steel because of the apparent effects of processing variables.

FIELD STUDY OF FENCING MATERIALS IN A MARINE-ATMOSPHERIC ENVIRONMENT–RESULTS OF UP TO THREE YEARS OF ATMOSPHERIC EXPOSURE AND CORROSION RATE DETERMINATION

Naval Civil Engineering Laboratory. Eddy S. Matsui. June 1972. 47 pages.

AD–746 842

The commonly used chain-link fencing is known to be very susceptible to corrosion from sea spray. There are newer types of chain-link fencing available which are more corrosion-resistant and require less maintenance in corrosive environments; however, performance data has been lacking for these types. This report provides such data for 15 different systems which were exposed to a natural marine-corrosive environment for periods of up to three years. The best performance found thus far is that of vinyl-clad galvanized chain-link fence and accessories. The slightly higher cost of these systems appears to be economically well justified on the basis of outstanding corrosion resistance, longer service life, and other benefits provided by the vinyl coating.

HYDROGEN ENVIRONMENT EMBRITTLEMENT

National Aeronautics and Space Administration, Lewis Research Center. Hugh R. Gray. 1972. 30 pages.

N72–27574

The document presents a review of hydrogen environment embrittlement as a background for standardizing test methods for detecting and evaluating this type of embrittlement. The effects of test techniques, hydrogen pressure, purity, strain rate, stress concentration factor, and test temperature are discussed. Characteristics of internal reversible hydrogen embrittlement and hydrogen reaction embrittlement are also discussed.

PROCEEDINGS OF THE FIFTEENTH ANNUAL APPALACHIAN UNDERGROUND CORROSION SHORT COURSE (1970)

West Virginia University, Engineering Experiment Station. Donald M. Bondurant. December 1970. 607 pages.

PB–211 136

This book is comprised of both technical and nontechnical presentations of the practical and theoretical aspects of underground metallic corrosion. It provides both elementary and advanced treatments of the causes of corrosion, instrumentation, corrosion surveys, cathodic protection, pipe coatings, and miscellaneous methods of corrosion control. The structures of primary concern are underground cables and pipelines.

LITERATURE SURVEY OF CORROSION INHIBITORS FOR RECIRCULATING COOLING WATER CORROSION INHIBITION

Dow Chemical U.S.A., Rocky Flats Division. John L. Briggs. July 1972. 18 pages.

RFP–1868

The prevention of metallic corrosion in recirculating cooling water ystems has been a subject of extensive study for the past thirty years. The use of chemical inhibitors has progressed to the point hat by judicious selection of inhibitor treatment, metallic corroion may be effectively controlled in most recirculating cooling water systems. This document provides a review of the published iterature on the subject. It covers inhibitor classification, inorganic athodic inhibitors, organic inhibitors, protective film theory, and dsorption theory. The data presented should be helpful in the election of inhibitors for effective water treatment.

SEWING THREADS FOR THE APPAREL INDUSTRY

National Bureau of Standards, Institute for Applied Technolog
and Apparel Research Foundation, Incorporated. Josephine M
Blandford, and Harriet A. Baker. May 1971. 163 pages.

COM–72–10515

This document provides detailed procedures for evaluating prop
erties of sewing threads of interest to apparel manufacturers. Th
test programs involve the determination of (1) the quality o
threads purchased by the apparel manufacturer, and (2) the pe
formance of the threads in the apparel product. Reprints ar
provided of the original articles describing each of the 21 tes
procedures which make up the test programs. In addition, result
are given of tests which were performed on representative sample
of commercially available threads of soft and mercerized cotton
core and spun polyester, and nylon. The properties covered in
clude size, shrinkage, strength, elongation, modulus, and elasticit

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TESTING PROGRAMS FOR THE APPAREL INDUSTRY. EVALUATION OF MATERIALS AND COMPONENTS. PART I. (SECOND EDITION)

Apparel Research Foundation, Incorporated. Josephine M. Blanc
ford, and Phyllis L. Bensing. May 1971. 43 pages.

COM–72–10516

TESTING PROGRAMS FOR THE APPAREL INDUSTRY. EVALUATION OF MATERIALS AND COMPONENTS. PART II. (SECOND EDITION)

Apparel Research Foundation, Incorporated. Josephine M. Blanc
ford, and Phyllis L. Bensing. May 1971. 256 pages.

COM–72–10517

This two-part report describes textile testing programs of variou
levels of sophistication and which are based on standard testin
procedures. They provide means for determining the conformanc
of textile products to the manufacturers', purchasers', and con
sumers' desired or specified requirements for appearance, pe
formance, or other properties. The test methods may serve t
verify the reliability of test data obtained from the mill or supplie
provide valid grounds for the rejection of misrepresented, inferio
or incompatible textile items; and forestall the cutting or fabrica
tion of sub-standard materials. Part I of the report provides detail
of minimum, intermediate, and advanced testing programs. Tes
equipment, their characteristics, and their sources of supply ar
tabulated. Part II is comprised of reprints of sixty-eight previousl
published papers describing the test methods essential to the con
duct of the testing programs.

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A SURVEY OF SOLID LUBRICANT TECHNOLOGY

Weapons Laboratory at Rock Island, Research Directorate. Peter Martin, Jr. March 1972. 28 pages.

AD–741 764

Solid lubricants may find application both in extreme environments where oil and grease lubricants cannot be used, and under moderate environmental conditions as replacements for oils and greases. The use of solid lubricants provides the following advantages: Dry airborne dust does not collect; high load capacities are realized; and simpler design by elimination of the need for oil seals and pumps is permitted. The outstanding characteristic of these lubricants is the concept of permanent lubrication for the life of the system. This document provides a survey of the solid lubricant literature to indicate the current state-of-the-art and to provide a basis for the optimum selection of solid lubricants. It covers solid lubricant powders, bonded film solid lubricants, and solid lubricating powders.

METALLIC DEBRIS MONITOR FOR RECIRCULATING LUBRICATING OIL

Franklin Institute Research Laboratories. Richard H. Hollinger. April 1972. 53 pages.

AD–745 205

Oil-lubricated surfaces, such as gears and bearings in a mechanical ystem, ordinarily fail through surface fatigue. The mechanism of failure involves the introduction of micro-cracks in load-supporting surface. The portions of the surface bounded by the cracks re subsequently lifted from the part and appear in the lubricating oil as metallic flakes. The surface thus exposed further degrades, nd the process continues until the part is weakened and fails, or ntil frictional forces are sufficiently excessive to result in shutdown of the system. This report describes the design, development, nd evaluation of a sensor which can be installed in-line in a recirculating oil system, and which shows the amount of metallic particles in the system and the rate at which the particles are eing generated. Monitoring a system with this device will show when the system has reached its initial failure point. The operaion of the sensor involves the filtration of the particles, their eposition in the annulus of a capacitor, and measurement of the esulting change in capacitance.

SOLID LUBRICANTS. A SURVEY

Midwest Research Institute. M. E. Campbell. 1972. 140 pages.

N72–25476

The technology of solid lubrication has advanced rapidly in recent ears, due primarily to the needs of the aerospace industry. This growth has led the National Aeronautics and Space Administra-

Lubricants
(continued)

tion to look seriously for non-aerospace applications. In this survey, solid-lubricant information has been collected from all available sources, and is presented in a summary form that will help a broad range of readers to better understand the mechanism of lubrication by solid materials. The topics discussed include: A history of solid lubrication; kinds of lubricating solids; bonded lubricants; new developments; methods of applying solid lubricants; methods of evaluation; environmental effects; novel materials; and designs for the use of solid lubricants. A bibliography of 140 entries is included.

Metals and Alloys

RHENIUM ALLOYS—IRON GROUP METALS (ELECTRODEPOSITION AND PROPERTIES)

Watervliet Arsenal, Benet R and E Laboratories. V. Peter Greco. October 1971. 70 pages.

AD–741 362

Evidence indicates that rhenium is the only refractory metal that can be successfully electrodeposited in aqueous electrolytes. Some of the properties of rhenium deposits which are responsible for its commercial success are its high melting point and high values of chemical resistance, hardness, and wear resistance. However, electrodeposited rhenium has a number of short comings, most of which may be overcome by codepositing it with the iron group metals. In this manner cathode current efficiency is increased, stress cracks are minimized or eliminated, mechanical and chemical properties are improved, thickness can be improved, and less rhenium is consumed. This report provides a brief review of rhenium and its alloys, and then gives the results of an investigation of some of the metallurgical properties of rhenium alloyed with the iron group metals by electrodeposition. In particular, it is shown that Co-Re and Fe-Re alloys can be obtained that are sound, thick (3–7 mils), smooth, and which can be considered for industrial applications.

HIGH STRENGTH LIGHT ALLOY MATERIALS FROM SPECIALLY CAST INGOTS

Massachusetts Institute of Technology, Department of Metallurgy and Materials Science. R. Mehrabian, D. Apelian, T. A. Caldwell, and M. C. Flemings. April 1972. 234 pages.

AD–742 656

This document considers several aspects of continuing studies on the solidification and thermomechanical processing of aluminum ingots. Included are the results of studies on the removal of oxide and other particulate materials from molten aluminum. The removal of such impurities is desirable since their absence improves the properties of the cast product, and their presence may cause production impedances and delays. It is shown that particles of different size ranges may effectively filtered by proper choice of filters. In another phase of the work, it has been demonstrated that die castings can be made from partially solidified aluminum alloy, and that such castings are comparable in quality to conventional (liquid metal) castings. Potential advantages of this new process include: Longer die life, improved soundness, reduced cycle time, and improved mechanization of metal handling.

ENGINEERING DATA ON NEW AEROSPACE STRUCTURAL MATERIALS

Battelle Columbus Laboratories. O. L. Deel, and H. Mindlin. December 1971. 293 pages.

AD–746 761

A major difficulty that design engineers frequently encounter, especially for newly developed materials, materials processing, and product forms, is a lack of sufficient engineering data information to evaluate the relative potential of these developments for a particular application. This document provides detailed data sheets covering the physical and mechanical properties of eight recently available alloys. The alloys were developed to meet the rigorous demands of modern air and space systems but they may, of course, find application elsewhere. The following are the alloys included: Udimet 700 (a nickel-base alloy); X5090 (basically Al–7%Mg); AF2–IDA (nickel-base alloy); Inconel 625 (a nickel-chromium alloy containing significant percentages of molybdenum, niobium, and tantalum); HA–188 (a cobalt-base alloy containing fairly large percentages of Cr, W, and Ni); Custom 455 (a martensitic age-hardenable stainless steel); PH 14–8 Mo (a precipitation hardenable stainless steel); and 6Al–2Sn–4Zr–2Mo Titanium. The properties of concern include tension, compression, shear, bend, impact, fracture toughness, fatigue, creep, stress-rupture, and stress corrosion.

INCLUSIONS IN HIGH-STRENGTH AND BEARING STEELS—THEIR DEPENDENCE ON PROCESSING VARIABLES AND THEIR EFFECT ON ENGINEERING PROPERTIES

Colt Industries Incorporated, Crucible Materials Research Center. J. J. Hauser, and M. G. H. Wells. February 1970. 177 pages.

AD–876 824

It is known that the presence of non-metallic inclusions in steels s significantly detrimental to the attainment of optimum strength. However, to substantially eliminate inclusions would be extremely expensive. A more economical approach is to reduce the number and size of these inclusions to a level compatible with performance requirements. This report concerns a study which was undertaken o obtain quantitative inclusion data so that the effects produced by various steelmaking practices and processing variables can be related to the resulting mechanical properties. Data are provided on the relative influence of inclusions on the various critical mechanical properties of several steels. Information is also given on the relative cleanliness of steels produced by various steelmaking methods.

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Miscellaneous Materials

ENVIRONMENT-SENSITIVE HARDNESS OF NON-METALS

Martin Marietta Corporation, Research Institute for Advanced Studies. A. R. C. Westwood, and N. H. Macmillan. April 1972. 80 pages.

AD–742 462

This paper presents an account of some of the ways in which non-corrosive chemical environments can influence markedly the hardness of non-metallic crystals and glasses. Such effects are more pronounced in non-metals than in metals, and it is becoming apparent that the utilization of these effects to facilitate the machining, drilling, compaction, and comminution of non-metals could provide significant technological benefits in the near future. The review is intended to provide a useful perspective on the observed phenomena and current level of understanding in this field of research. For example, information gained from conventional microhardness tests is used to illustrate the various ways in which chemisorbed surface species can influence the hardness of non-metals. Possible explanations for these effects and the experiments devised to distinguish between rival theories are discussed. Also, an account is given of recent studies on the environment-sensitive hardness of soda-lime glass. Some ways in which adsorption-induced changes in hardness may be used in practice are discussed; these range from improvements in the machining of ceramics, to the drilling of rock, to perhaps the eventual control of earthquakes.

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MATERIALS AND PROCESSES FOR ELECTRON DEVICES

National Materials Advisory Board. May 1972. 323 pages.

AD–745 745

A survey is provided of the field of materials and processes for solid state electronic devices. The status, needs, and deficiencies in materials of interest are identified; and technical approaches for alleviating deficiencies are suggested. The particular material areas covered include: Elemental semiconductors; compound semiconductors and superconductors; magnetic materials for electron devices; composite structures; inorganic dielectric materials; and organic dielectrics.

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INVESTIGATION OF SULFUR AS A STRUCTURAL MATERIAL

Southwest Research Institute. John M. Dale, Jerry V. Fox, and Allen C. Ludwig. August 1968. 66 pages.

AD–840 380

This report provides the results of an investigation of the principal areas wherein improvements would greatly expand the application potential of sulphur-based structural materials. One result was the development of a glass fiber mat which is compatible with sulfur formulations. An optimum sulphur composition was also developed which, when used with the glass fiber mat, formed a composite with good flexural strength, fire resistance, and abrasion resistance. Potential applications include floors and helicopter landing pads, which can be formed in place directly on the bare ground. In addition, the feasibility of making building blocks of rigid sulphur foam was demonstrated. The mechanical properties of the blocks were determined to be sufficient for wall construction.

MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING

Bonding and Joining

A NUMERICAL, THERMO-MECHANICAL MODEL FOR THE WELDING AND SUBSEQUENT LOADING OF A FABRICATED STRUCTURE

Brown University, Division of Engineering. Hugh D. Hibbitt, and Pedro V. Marcal. March 1972. 62 pages.

AD–744 212

The welding process is of fundamental technological importance because of its universal use as a fabrication technique. By the very nature of the process, welding subjects parts of the structure to an extremely severe thermal history, so that weld sections are often the critical determinants of the life and working strength of a fabricated structure. A general numerical model of the weld process (from a structural viewpoint) is now presented which is capable of predicting the structurally significant effects of the process on the basis of known behavior of the material and known parameters of the process. The welding and subsequent loading processes are viewed as a boundary layer problem which can be formulated mathematically with knowledge of the material behavior and of the primary boundary conditions, such as heat input rate, weld bead deposit rate, cooling conditions, etc.

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JOINING ALUMINUM TO STAINLESS STEEL BY ELECTROPLATING

Sandia Laboratories (AEC), Metallurgy Division. J. W. Dini, H. R. Johnson, and J. R. Helms. October 1971. 39 pages.

SCL–DC–710084

A procedure for joining aluminum to stainless steel for structural applications is described. Basically, the method involves copper striking the parts, mating them, and electroplating the joint with nickel. Techniques for certifying parts so formed are described.

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Building Technology

EVALUATING ADHESIVES FOR BUILDING CONSTRUCTION

U.S. Department of Agriculture, Forest Products Laboratory. R. H. Gillespie, and W. C. Lewis. 1972. 14 pages.

AD–742 612

Adhesive bonding in building construction can lead to more efficient use of materials with prospects of lower costs and better performance. Consideration is given in this report to the relevant properties of adhesives for the purpose of providing a basis for designing with them in the same way as with any other structural connection. A proposed testing program is outlined which is intended to insure the proper selection and use of adhesives in building construction. The discussion is generally in terms of bonding wood, although the principles apply to other adherends as well.

PAPER HONEYCOMB SANDWICH PANELS AS LIGHTWEIGHT STRUCTURAL COMPONENTS

National Bureau of Standards, Building Research Division. T. W. Reichard. April 1972. 12 pages.

COM–72–50530

Lightweight in buildings can be advantageous when the saving in weight results in some functional or economic gain. Structural sandwiches are a logical choice when designing lightweight buildings and they are being used quite extensively in the United States at the present. Sandwich panels are available in a fairly wide range of material combinations, but those used in buildings are almost always made with kraft paper honeycombs. This document provides a review of current practice in the U.S. with regard to the use of these sandwich panels in single-story buildings. Descriptions and properties of typical paper honeycomb cores are given, and some of the factors which are considered when choosing sandwich facings and adhesives are given.

PERFORMANCE CONCEPTS IN BUILDINGS. VOLUME 2: OPENING ADDRESSES, RAPPORTEUR REVIEWS, AND DISCUSSIONS

National Bureau of Standards, Institute for Applied Technology. Bruce E. Foster (Editor). September 1972. 168 pages.

COM–72–50850

This document contains materials resulting from an international symposium on performance concepts in buildings, held 2–5 May 1972, in Philadelphia, Pa. It includes the opening remarks and general addresses; reviews of the papers and discussions of each of the six sessions; and the discussions themselves. The actual papers presented at the symposium are published in Volume 1 (order number—COM–72–10309; price $6.50), which is described in the October 1972 issue of AMTID, page 40.

INDUSTRIALIZED FOUNDATIONS FOR LOW-RISE LIGHT-WEIGHT BUILDINGS

Virginia Polytechnic Institute, Wood Research and Wood Construction Laboratory. Viswanath Krishna Kumar. May 1972. 48 pages.

PB–210 797

Recent years have seen many changes in building technology towards industrialization and mass production. Thus far, however, industrialization of building has been applied to the superstructure of houses and rarely to the foundation. It is contended, in this report, that industrialization of foundations for low-rise, lightweight buildings in technically feasible and that such foundations can lead to considerable savings. Although most of the subject matter deals with low-rise houses, it is equally applicable to lightweight, one- or two-story buildings for other uses. The subject matter covers: Justifications for producing foundations on an industrialized basis; foundation functions, types, and materials; overview of new foundation systems; and proposed foundation systems. The report is largely analytical in nature, but it also covers some experimental work conducted in connection with a novel foundation system.

LOW-COST WOOD HOMES FOR RURAL AMERICA–CONSTRUCTION MANUAL

U.S. Department of Agriculture, Forest Products Laboratory. L. O. Anderson. May 1969. 114 pages.

PB–211 640

Improved housing for rural families means, in many cases, a home that is low in first cost, easily maintained, and equipped for good family living. This manual provides details on the construction of such housing, with special reference to methods and materials which will hold down costs, but will insure quality. It gives step-by-step information on every phase of house construction, from the construction of the foundation or supporting units to the final painting and finishing. The manual may be particularly useful to those who plan rural housing efforts; the contractors and skilled and unskilled laborors who will be concerned with the actual construction; and the occupant who will gain an understanding of how his home is constructed and how to make improvements as his situation allows.

Civil Engineering

EXCAVATION SEISMOLOGY

Honeywell, Incorporated, Systems and Research Center. D. E. Soland, H. M. Mooney, S. Singh, D. Tack, and R. Bell. March 1972. 228 pages.

AD–742 146

The document describes efforts directed toward the development of techniques and equipment, using sound waves, with which to "see" ahead of a tunnel excavation in hard rock. The principal ecognized need is to provide early warning hazards or of geoogically changing conditions ahead of the excavation working face or in the roof of the opening. Such conditions include fractures or aults, presence of water, and changes in rock type. A system is proposed which utilizes a small general-purpose computer, a repetiive seismic source, a receiver array, and an oscilloscope display.

A discussion is provided of the system concept and of general principles; laboratory and field experiments are described; results are given of array processing investigations using recorded experimental data; and a description is given of a digital implementation of the recommended approach.

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FUNDAMENTAL STUDIES IN THE USE OF SONIC POWER FOR ROCK CUTTING

Ohio State University Research Foundation. Karl F. Graff. December 1971. 223 pages.

AD–740 808

Problems inherent to rock excavation, particularly in tunneling, have led to a search for new technology. Penetration of rock faces with tools driven by sonic transducers is currently receiving attention. The report discusses high-power transducers previously developed for other purposes, operating from fixed-frequency electrical systems and coupled to the tool by the intermittent contact. A study of sonic tool impact on rock indicates that the system is feasible. An analysis is made of the stresses developed during sonic impact, the vibrational characteristics of the transducer, tool impact, and the sonic interaction process. Results are also reported on experiments with the sonic transducer tip.

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LAYERED PAVEMENT SYSTEMS—PART I, LAYERED SYSTEM DESIGN; PART II, FATIGUE OF PLAIN CONCRETE

Naval Civil Engineering Laboratory. J. B. Forrest, M. G. Katona, and D. F. Griffin. April 1972. 78 pages.

AD–742 337

The construction of portland cement concrete overlays on asphaltic concrete pavements used for airport runways and parking aprons is a method of strengthening these structures, to accommodate heavier traffic, without complete reconstruction. The first part of this report indicates that elastic layered analysis provides a better design approach to such layered pavement systems than any other currently available technique. The second part is a review of the literature about fatigue of plain concrete, with emphasis on aspects related to the development of a rational design procedure for layered airfield pavements.

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RESEARCH IN GROUND SUPPORT AND ITS EVALUATION FOR COORDINATION WITH SYSTEM ANALYSIS IN RAPID EXCAVATION

Jacobs Associates. George E. Wickham, and Henry R. Tiedemann. April 1972. 178 pages.

AD–743 100

A method of predicting subsurface conditions for tunnel construction, based on pre-construction geologic data, is described. The prediction is correlated to different support systems which would satisfy the ground support requirements for most rock tunnels. This correlation is made by use of a concept which compares and relates various support systems to a common datum or support requirement. New support concepts are examined on the basis of their adaptability to underground rapid excavation. Economic evaluations are made for several tunneling situations using either conventional or innovative support systems.

RESEARCH IN LONG HOLE EXPLORATORY DRILLING FOR RAPID EXCAVATION UNDERGROUND

Jacobs Associates. Thomas N. Williamson. April 1972. 33 pages.

AD–743 224

It has been recognized that rapid excavation techniques for underground tunneling are creating a need to have much better methods of sampling materials ahead of boring machines. These same techniques might also be used for pre-job estimating prior to either rapid or conventional excavation. This report describes the design and construction of a drill for such purposes which is capable of making a horizontal hole 4 inches in diameter and 1,000 feet long. Many of the components of the system are commercially available. The drill may be used to probe rock ahead of construction for planning purposes, and to provide information on potential hazards such as bad roof conditions, gas, or water.

PRACTICAL GUIDANCE FOR ESTIMATING AND CONTROLLING EROSION AT CULVERT OUTLETS

U.S. Army Engineer Waterways Experiment Station. B. P. Fletcher, and J. L. Grace, Jr. May 1972. 45 pages.

AD–743 461

A summary is provided of research conducted over a nine year period, at the Army Engineer Waterways Experiment Station, to develop practical guidance for estimating and controlling erosion downstream of culvert and storm-drain outlets. Efforts were concerned with means of estimating scour to be anticipated downstream of outlets, evaluation of various schemes of protection for controlling erosion, and determining the limiting discharges for various energy dissipators. Emperical equations and charts are presented for estimating the extent of localized scour, the size and extent of various natural and artificial type revetments, and the maximum recommended discharge for each type of energy dissipator investigated. With these results, designers can select appropriate and alternative schemes of protection for controlling erosion downstream of culverts and storm-drain outlets.

CONTINUOUS HIGH VELOCITY JET EXCAVATION

Bendix Research Laboratories. Ray F. Chadwick, and Michael C. Kurko. May 1972. 96 pages.

AD–744 014

Increasing emphasis is being devoted to the location of urban utility and transportation systems underground, such location being both impervious to weather conditions and maintainable at reduced costs. Relocation of surface facilities underground, however, will require major improvements in tunneling technology. The foremost problem in this regard is cutting through hard rock. A method of material excavation presently under investigation utilizes high pressure fluid jets in combination with existing tunneling and excavation techniques. The report discusses the mechanics of high velocity jet excavation, and describes a test program using samples of three varieties of granite and one each of quartzite, sandstone, marble, basalt, and limestone. Fluid pressures ranged from 20,000 to 80,000 pounds per square inch, using special nozzles. Power requirements and excavation rates are compared with those of a conventional system.

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EVALUATION OF FLARED OUTLET TRANSITIONS

Army Engineer Waterways Experiment Station. B. P. Fletcher, and J. L. Grace, Jr. June 1972. 32 pages.

AD–745 882

Paved aprons are probably the oldest and simplest form of protective device for preventing excessive scour at culvert outlets. This report provides the results of model tests of various lengths and elevations of horizontal aprons with flared sidewalls. The data are presented in the form of dimensionless parameters and design charts for ready determination of (1) the maximum discharges permissible with a given diameter, given lengths of flared apron, and various depths of tailwater; and (2) the lengths of flared apron required for a given diameter culvert, a given discharge, and various depths of tailwater.

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AQUATIC PLANT CONTROL PROGRAM

U.S. Army Engineer Waterways Experiment Station. Edward O. Gangstad (Editor). June 1972. 153 pages.

AD–745 895

The copious growths of aquatic plants frequently encountered in the waterways of warm regions affect man in many adverse ways. Among other things, they interfere with every degree and type of water transportation, they threaten agriculture, they have harmful effects on beneficial fish and wildlife, and they provide very favorable mosquito breeding grounds. This document is intended as a survey of the problems resulting from the spread of aquatic plants and of the means for controlling or eradicating these plants in navigable waterways. It is comprised of papers presented at a conference on the subject held in January 1972. Some of the specific topics covered include: Mechanical equipment used for aquatic plant control; integrated mechanical, chemical, and biological control systems for aquatic plants; beneficial aquatic plants in coastal areas; laser system for control of the growth of water hyacinths (Eichhornia crassipes) and other plants.

AN INVESTIGATION OF THERMAL-MECHANICAL FRAGMENTATION OF ROCK

University of Missouri. George B. Clark, Terry F. Lehnhoff, Vernon D. Allen, Mahendra R. Patel, and Jaw K. Wang. June 1972. 289 pages.

AD–746 196

Excavation by continuous methods has advanced in the last decade for soft and medium rock, but the difficulty of penetrating hard rock has delayed progress in that field. Since the cyclic drill and blast methods currently in use for hard rock lack the advantages of continuous operation and smooth boring, new methods of disintegration are being sought. A combination of thermal weakening-spalling and mechanical-thermal fragmentation appears to offer a promising potential for the excavation of hard rock not containing quartz. The report outlines the critical characteristics of any effective rock disintegration-excavation system and discusses the parameters involved. A discussion is given of technique, heat energy coupling, thermal stresses, mechanical fragmentation, specific energy and crushing laws, and thermal-mechanical fragmentation tests. Some conclusions are drawn and recommendations are made.

DESIGN PARAMETERS FOR WATER JET TUNNELING MACHINES

Oak Ridge National Laboratory (AEC). Charles A. Hahs. 1971. 19 pages.

CONF–720602–1

The rate of tunneling through rock has been improving during the ast few years. Conventional techniques have been replaced by continuous tunneling machines, and the prospects for using a combination of methods to tunnel at higher velocities are good. The cost per cubic foot for cutting holes or tunnels usually increases dramatically if the height of the opening is less than 8 feet. In such cases, water jets may be suitable cutting tools. This document discusses a method developed to help designers forecast the performance of water jet equipped tunneling machines where only imited laboratory data are available. Experimentally determined data are used to forecast the cutting rates for sandstone, limestone, and granite. The horsepower transmitted to the rock face, penetration of the jet into the rock, specific energy, nozzle thrust, and the tunnel cutting rates to be expected when a given rock type is cut are presented.

HEAT SHRINKABLE TUBING AS SEWER PIPE JOINTS

Western Company of North America. June 1971. 106 pages.

PB–208 816

One of the most significant problems with sewage collection systems is the exfiltration of sewage and the infiltration of water through deteriorated or leaking lines. The joint between each section of sewer pipe can be identified as a primary source of this problem. The conventional joint system also presents several inherent difficulties to sewer installers and shippers. An investigation was undertaken to determine whether heat shrinkable plastic tubing (HST) would provide a solution to these difficulties. A wide variety of HST materials were tested in addition to conventional joints for clay, concrete, and asbestos-cement pipes. The results indicate that a polyolefin with a polymeric base hot melt adhesive produced the most durable, watertight joints and were significantly superior in performance compared to existing pipe joining mechanisms. In addition, a cost analysis indicates that HST joints are economically feasible and compare favorably to conventional joints when considering both material and installation costs. The HST joint requires no significant departure from current installation practice and is equally adaptable to repair of installed commercial pipe and joints.

AN ECONOMIC ANALYSIS OF EROSION AND SEDIMENT CONTROL METHODS FOR WATERSHEDS UNDERGOING URBANIZATION

Dow Chemical Company. G. H. Brandt, E. S. Conyers, M. B. Ettinger, F. J. Lowes, J. W. Mighton, and J. W. Pollack. February 1972. 191 pages.

PB–209 212

Economic benefits are expected from controlling erosion and sediment during urban construction, but control costs have not been previously related to benefits. This study develops perspective on the relative impact of this sediment source, and analyzes the cost and effectiveness of numerous control systems, some of which include soil stabilizing chemicals and chemical flocculants. Furthermore, on-site and downstream sediment damages are estimated for varying sediment loads. Lastly, the study presents some cost benefit analyses which may be considered when drafting sediment legislation. The report includes a bibliography and survey of the pertinent literature.

A PROGRAM FOR IMPROVING THE EFFECTIVENESS OF UNDERGROUND CONSTRUCTION

American Society of Civil Engineers, Underground Research Council. R. F. Baker, D. A. Day, N. FitsSimons, D. W. Hill, R. M. Michaels, H. G. Poertner, and M. C. Wilkinson. February 1972. 236 pages.

PB–209 270

Greater use of the underground is being urged as one means of satisfying the ever increasing need for space in urban areas. An ongoing study is aimed to determine whether such utilization will produce significant improvements in man's welfare. The report indicates that economic, social, and environmental benefits are indeed possible, provided a gap is closed between current capabilities and the required construction rates and costs. A discussion is given of alternatives in research and development, consequences of shifting life support functions underground, impact on residential systems, commercial and industrial structures, water resource systems, liquid waste management, solid waste disposal, transportation, communication, and energy production. A benefit cost analysis is made of civil works and construction programs. Other topics of concern are employment, health, constraints, and policies.

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PROCEEDINGS, WORKSHOP ON SEDIMENT CONTROL

University of North Carolina, Water Resources Research Institute. James M. Stewart, and Joseph A. Phillips (Editors). February 1972. 102 pages.

PB–210 147

Recent concern over both stream pollution and general degradation of the landscape has brought increased interest in sediment control and prevention of soil erosion in urban areas. This document contains the papers presented at a workshop which addressed itself to the problem of sediment control. The major areas covered are: Review of policies, programs, and problems in sediment control; concerns for sediment control; and local government concern in sediment control.

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TUNNEL VENTILATION AND AIR POLLUTION TREATMENT

Mine Safety Appliance Research Corporation. S. J. Rodgers, F. Roehlich, Jr., and C. A. Palladino. October 1971. 259 pages.

PB–210 360

This report provides the results of an effort to evaluate current air quality in existing vehicular tunnels and to determine a means of upgrading air quality in existing and future tunnels. Specifically, the following topics are covered: A survey of the types and quantities of air impurities in vehicular tunnels; an evaluation of the physiological effects of these impurities on tunnel workers and transients; establishment of air quality criteria for vehicular tunnels; a review of available methods and procedures for improving air quality in tunnels; the results of a laboratory evaluation of the most promising methods of tunnel atmosphere purification; recommendations for the types of impurity monitors which should be used in tunnels. A fairly extensive bibliography, arranged according to general subject, is included.

DEEP TUNNELS IN HARD ROCK

University of Wisconsin—Milwaukee. Vinton W. Bacon, and Paul A. Seaburg (Editors). February 1971. 211 pages.

PB–210 854

This document is comprised of a group of papers presented at an engineering institute, held in November 1970, which was concerned with deep tunneling in hard rock as a solution to combined sewer overflow and flooding problems. The topics covered include: The flooding and combined sewer overflow problem in urban areas; experiences and future plans for hard rock tunnels in the Chicago area; the role of storage in economics of sewage treatment plant design; the potential of pumped storage for hydroelectric generation in multi-level deep tunnel systems; European development and experience with tunneling machines in hard rock tunneling; experience in Edmonton, Canada with emphasis on pneumatic conveyance of muck.

A DESIGN PROCEDURE FOR HIGH CUTS IN JOINTED HARD ROCK—THREE DIMENSIONAL SOLUTIONS

University of California (Berkeley). Francois E. Heuze, and Richard E. Goodman. April 1971. 143 pages.

PB–210 878

This report demonstrates a rational procedure for the design of cuts in jointed hard rock. In particular, it concerns the stability of high cuts in sheeted, slabby, buttressed or blocky rock, which has little in common with that of slopes in a continuous medium. The nature of the problem is first defined within the context of rock slope engineering. This, in turn, leads to identification and evaluation of the input required for analysis. Then the different tools available for solving the problem at hand are described. The final stage consists in integrating the above into a complete procedure for design. The report is written for use as a design manual, for persons who may have varying degrees of knowledge in the areas under consideration. Thus frequent resort to examples is made to illustrate the most important concepts.

SAN JUAN RIVER HYDROELECTRIC PROJECT. FEASIBILITY REPORT

Tippetts-Abbett-McCarthy-Stratton; and INGETEC (Colombia). June 1971. 249 pages.

PB–212 373

The San Juan is a large river which drains a portion of western Colombia between the Western Cordillera and the Pacific Coast, and which empties into the Pacific northwest of Buenaventura. This report examines the technical and economic soundness of a hydroelectric project on the lower San Juan which would provide a large usable water storage capacity and a large electricity generating capacity. The topics covered include: The power market, both present and projected; geological description of the dam and reservoir sites; requirements and design of project components, including dams power plant, dikes, transmission lines, and navigation channel; operation studies, including reservoir flood routing; construction program; project costs; economic feasibility; socioeconomic effects of the project; hydrology of the San Juan basin; and evaluation of timber resources in the San Juan valley.

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Electrical and
Electronic Engineering

ENGINEERING DESIGN HANDBOOK. ELECTRICAL WIRE AND CABLE

Army Materiel Command. September 1969. 297 pages.

AD–865 109

This handbook contains basic information and fundamental data in the design, usage, and development of wire and cable systems. Its objective is to provide a practical guide to the correct design of equipment to meet the exacting transmission requirements of the many and varied aspects of modern electronic and electrical systems. The following general topics are considered: Conductors, insulation materials, hook-up and interconnecting wire, bundled wires, coaxial cable, control and signal cables, special purpose cables, and telephone cables. Also included are a glossary of relevant English-language terms, and a listing of equations for quick reference.

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STANDARD SPECIFICATIONS FOR PUBLIC SAFETY. MULTIPURPOSE VHF–FM TACTICAL TRANSCEIVERS, OPS/FM–1B AND OPS/FM–5B

Agency for International Development, Office of Public Safety. February 1968. 158 pages.

PB–212 191

This document provides a standard for VHF/FM radio transmitter/receiver equipment for use in worldwide public safety programs. The OPS/FM–1B is a hand-held transceiver, while the

OPS/FM–5B operates as a man-pack portable, mobile, or fixed station. Both are fully transistorized and operate in the 148–170 MHz band.

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Environmental Technology

A LITERATURE SURVEY OF OCEAN POLLUTION

Catholic University of America, Institute of Ocean Science and Engineering. H. H. Shih. May 1971. 116 pages.

AD–743 101

For centuries man has used the oceans as, among other things, a receptacle for waste. The ocean appears to have a natural capacity to assimilate certain amounts of waste material with little or no lasting harm, but in an increasing number of instances this limit has been exceeded. This document provides a survey of the available literature on ocean pollution. A general discription is given of the worldwide ocean pollution problem and, then, the chief pollutants and their sources are discussed. The effects and control measures of the various types of pollution are described, and areas of needed research are indicated. A glossary of terms often encountered in fields related to ocean pollution is included, as is a bibliography which is arranged according to general subject matter.

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TRITIUM AND ITS EFFECTS IN THE ENVIRONMENT—A SELECTED LITERATURE SURVEY

Battelle Memorial Institute, Columbus Laboratories. A. W. Rudolph, T. E. Carroll, and R. S. Davidson. June 1971. 343 pages.

BMI–171–203

This bibliography provides detailed subject access to the literature on tritium and its effects in the environment, with emphasis on its effects on man. Each entry is accompanied by an indicative abstract. Subject, author, and report number indexes are included.

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PROCEEDINGS OF THE SYMPOSIUM ON AIR POLLUTION, TURBULENCE, AND DIFFUSION, DECEMBER 7–10, 1972

Sandia Laboratories (AEC). H. W. Church, and R. E. Luna (Authors). March 1972. 391 pages.

CONF–71–1210

The symposium was conducted to present viewpoints on the relationship between air pollution and atmospheric motion. Fifty-two papers are given which cover such topics as: Air resources management; atmospheric diffusion; remote sensing; LIDAR; air motion over cities; terrain effects; atmospheric turbulence; climatology; and mathematical models of pollution dispersion.

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MERCURY IN THE ENVIRONMENT—AN ANNOTATED BIBLIOGRAPHY

Oak Ridge National Laboratory (AEC). G. M. Caton, C. J. Oen, D. P. Oliveira, and G. U. Ulrikson. May 1972. 275 pages.

ORNL–EIS–71–8

This bibliography is comprised of 562 citations, each accompanied by an abstract, to the literature on the role of mercury in the environment. The entries are arranged according to the following subject categories: Reviews, bibliographies, and general papers; natural occurrence, mining, and extraction; uses and consumption; pollution sources and pollution; chemistry; control, abatement, and restoration; legal and political aspects; physiological and toxicological aspects; ecosystem movement. Author, subject, and title indexes are included.

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STATE-OF-THE-ART: 1971. INSTRUMENTATION FOR MEASUREMENT OF PARTICULATE EMISSIONS FROM COMBUSTION SOURCES. VOLUME I: PARTICULATE MASS—SUMMARY REPORT

Thermo-Systems Incorporated. G. J. Sem, J. A. Borgos, J. G. Olin, J. P. Pilney, B. Y. H. Liu, N. Barsic, K. T. Whitby, and F. D. Dorman. April 1971. 194 pages.

PB–202 665

STATE-OF-THE-ART: 1971. INSTRUMENTATION FOR MEASUREMENT OF PARTICULATE EMISSIONS FROM COMBUSTION SOURCES. VOLUME II: PARTICULATE MASS—SUMMARY REPORT

Thermo-Systems Incorporated. G. J. Sem, et al. April 1971. 225 pages.

PB–202 666

This report discusses sensing techniques available for application to automatic, continuous measurement of the rate of particulate mass emissions from fossil-fuel combustion facilities. Volume I contains brief discussions of all known particle sensing techniques. It is written for the engineer or planner who needs to know a few basic facts on the subject. The intent is to provide a quick reference guide. Volume II contains detailed discussions of particle sensing techniques as applied to emissions monitoring, including operating principles, historical data, and relative usefulness. Included are sections on power plant emission properties and extraction sampling probes. It is intended for the plant engineer, abatement and control officials, and others who may not be familiar with the detailed technology of these areas.

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SYSTEMS ANALYSIS OF THE EFFECTS OF AIR POLLUTION ON MATERIALS

Midwest Research Institute. Richard L. Salmon. January 1970. 192 pages.

PB–209 192

Economic justification of air pollution control measures is difficult. The need for such justification is great, however, and a logical first step is to determine that which can most readily be determined: materials damage. This document presents a systems analysis approach to measuring materials damage attributable to air pollution. This approach includes a classification of materials, a classification of air pollutants, and an enumeration of possible chemical and physical interactions of air pollutants and materials that produce direct or indirect economic damages. Other influencing variables such as time, meteorology, and degree of exposure to the atmosphere are identified wherever possible. The available data are presented in a series of tables which, although incomplete, allow reasonable estimates to be made of economic losses due to air pollution.

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COMPILATION OF AIR POLLUTANT EMISSION FACTORS

U.S. Environmental Protection Agency, Office of Air Programs. February 1972. 164 pages.

PB–209 559

In the assessment of community air pollution, there is a critical need for accurate data on the quantity and characteristics of emissions from the numerous sources that contribute to the problem. The large numbers of these individual sources and the diversity of source types make conducting field measurements of emissions on a source-by-source basis at the point of release impractical. The only feasible method of determining pollutant emissions for a given community is to make generalized estimates of typical emissions from each of the source types. To do this an emission factor is used. This is a statistical average of the rate at which a pollutant is released to the atmosphere as a result of some activity, such as combustion or industrial production, divided by the level of that activity. The emission factors reported in this compilation cover most of the common emission categories: fuel combustion by stationary and mobile sources; combustion of solid wastes; evaporation of fuels, solvents, and other volatile substances; various industrial processes; and miscellaneous sources. When no source-test data are available, these factors can be used to estimate the quantities of primary pollutants (particulates, CO, SO_2, NO_x, and hydrocarbons) being released from a source or source group.

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OIL NITROGEN CYCLE. A BIBLIOGRAPHY

.S. Department of the Interior, Water Resources Scientific Infor-
iation Center. April 1972. 284 pages.

'B–209 931

his bibliography provides abstracts and bibliographic citations
r 201 publications dealing with the soil nitrogen cycle. A ma-
rity of the publications are concerned with nitrogen in soil as a
ater pollutant from such sources as surface water runoff, farm
astes, etc. A subject index is included.

SPHALTIC CONCRETE PLANTS ATMOSPHERIC MISSIONS STUDY

alentine, Fisher and Tomlinson. J. A. Crim, and W. D. Snowden.
ovember 1971. 93 pages.

B–210 137

he report summarizes previously unpublished emission data on
nited States asphaltic concrete plants. It shows a comparison
tween different sampling techniques and presents guidelines for
aluating the emissions of these plants. Included is a summary of
scriptive material on dust control equipment and background
formation on plant operations. The study is intended to provide
fficient descriptions and data, that when combined with other
ailable information, will provide complete descriptive and back-
ound data to local air pollution control agencies and industry
lated groups. Use of all the information will allow approxima-
on of overall plant emissions from production rate data.

NVIRONMENTAL INDICATORS FOR PESTICIDES

anford Research Institute. John Strickland, and Thomas Blue.
pril 1972. 129 pages.

B–210 666

ie management of pesticides and herbicides is an important gov-
nmental function because of the possible detrimental effects on
e environment from their misuse. The report identifies steps
iich should be taken for the collection and processing of data
cessary for the calculation of indicators which monitor pesticide
e. These indicators include production; consumption; raw ma-
ials; amounts found in food, water, air, animals, etc.; and
ilization as it relates to public health, crop yield, and recreational
d aesthetic values.

COLOGICAL IMPACT OF WATER RESOURCE EVELOPMENT. A TECHNICAL SESSION OF THE YMPOSIUM "WATER, MAN, AND NATURE"

ireau of Reclamation, Engineering and Research Center. D. A.
offman (Editor). June 1972. 31 pages.

3–210 838

This document is comprised of four papers presented at a symposium which was designed to establish communication between ecologists and engineers. The first paper presents some ecological information which should be considered along with other parameters in water resources management. It briefly considers the preconstruction ecological survey, predictive bioassay, simulation techniques, ecological quality control techniques, and systems management of water resources. The second paper provides a brief review of what is known of the ecological impact of fluctuating water levels in reservoirs. The third paper is a case history concerning the management, for environmental enhancement, of waste materials produced during the excavation of a canal in North Dakota. The final paper reports the results of an investigation of the effects on the fish habitat in a Utah river of the construction of a highway parallel to and across the river.

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REPORT OF THE UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT HELD AT STOCKHOLM, 5–16 JUNE 1972

United Nations, General Assembly. July 1972. 145 pages.

PB–211 133

This final report of the U.N. Conference on the Human Environment is comprised of three main parts. Part One concerns the action taken by the conference. It contains the declaration of the conference; the action plan for the human environment; the resolution of institutional and financial arrangements for the protection and improvement of the human environment; and resolutions on World Environment Day, nuclear weapons tests, and convening a second U.N. Conference on the Human Environment. Part Two of the report provides background on activities which lead to the proceedings of the Conference. Included here is information concerning attendance and the organization of work, a summary of the convening of the conference. Part Three contains the general debate, the establishment of the Working Group on the Declaration on the Human Environment; action on reports of committees and the Working Group; and adoption of the Action Plan for the Human Environment.

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DESERT ENCROACHMENT ON ARABLE LANDS: SIGNIFICANCE, CAUSES, AND CONTROL

Agency for International Development, Office of Science and Technology. August 1972. 61 pages.

PB–211 367

Attempts to settle the semi-arid regions of the world have often been hindered or thwarted by the seemingly relentless progression of adjacent deserts. Either because of climatic fluctuations or the effects of human activities on the ecological zones bordering desert areas, or due to a complex interaction of these two factors, marginal but potentially productive land has been absorbed into the ncroaching desert with attendant economic and social losses. This report was prepared to provide program managers in develop- ng countries and development assistance agencies with an over- iew of the causes and significance of the problem and the state- f-the-art of control methods. Particular attention is given to new xperimental methods for stabilizing the desert and event revers- ng its advance on a localized scale. Consideration is also given o the role of water management techniques in the containment f desert areas. An extensive bibliography is included, as is a isting of organizations which may be able to provide additional nformation and expertise on desert encroachment problems.

NGINEERING MEASURES FOR CONTROL OF CHISTOSOMIASIS

Jniversity of North Carolina, Department of Environmental ciences and Engineering. Frederick Eugene McJunkin. Septem- er 1970. 71 pages.

B–211 473

he water-related disease schistosomiasis (or bilharziasis) infects ore people today than ever before in history, perhaps as many as 00 million people. Its increasing incidence and widespread pre- alence are due in large measurement to tropical irrigation and ydroelectric projects, implemented by engineers. This report pro- ides background information on schistosomiasis and its control o enable engineers to work effectively with other professionals in esign and operation of schistosomiasis control programs. It also eeks to improve understanding on the part of epidemiologists, alacologists, physicians, and others of the role of engineers in ontrol of schistosomiasis. The present status of engineering easures for schistosomiasis control is summarized, and some ossible approaches and opportunities for more effective control f schistosomiasis by engineers are outlined. A bibliography of elevant publications is included.

EPORT ON THE CENTRAL AMERICAN WORKSHOP N THE ENVIRONMENT AND DEVELOPMENT, NTIGUA, GUATEMALA, JULY 25–30, 1971

.S. National Academy of Sciences, Board on Science and Tech- ology for International Development. July 1971. 36 pages.

B–211 487

he primary goals of the Workshop were: to stimulate awareness f environmental factors in economic development among leaders Central America; and to lay the groundwork for concerted ctions within the established framework of the Common Market ountries (Costa Rica, El Salvador, Guatemala, Honduras, and icaragua). This document records the issues discussed and the onclusions reached. The focus of the workshop was upon the dustrial, agricultural, and service industry factor. Consideration was also given to the human environment (principally population pressures), to planning at the regional level, and to educational consequences of environmental problems. (The papers presented at the Workshop, most of which are in Spanish, have been published in a volume entitled CONSERVACION DEL MEDIO AMBIENTE FISICO Y EL DESARROLLO. It is available from Instituto Centroamericano de Investigacion y Technologia Industrial, Apartado Postal 1552, Ciudad de Guatemala, Guatemala, C.A. The price listed is $CA 10.00.)

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THE ENVIRONMENTAL AND ECOLOGICAL FORUM, 1970–1971

U.S. Atomic Energy Commission, Office of Information Services. June 1972. 196 pages.

TID–25857

This document is comprised of papers presented in a forum series which was planned to provide an overview of the significant environmental, social, and economic aspects of electric-power generation, more specifically, the pros and cons of nuclear power production. It was organized to foster community understanding of environmental problems that increasingly tax society's capabilities for remedial action. The topics covered include: History of man's development and utilization of energy sources, and their ecological and human consequences; environmental impact of nuclear power plants; the radiation hazard for man; proposal for a rational policy to control radioactivity and other forms of pollution; radiation standards and radiation exposure of the public from nuclear power plants; adequacy of present radiation standards; the nuclear power information communication predicament; risk-benefit balance as applied to radiation exposure; benefits and costs of nuclear power; state of knowledge about low-level radiation.

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Highway Engineering

PROCEEDINGS, COMMITTEE ON COMPUTER TECHNOLOGY. NATIONAL CONFERENCE HELD AT MADISON, WISCONSIN, 23–24 JUNE 1971

American Association of State Highway Officials. June 1971. 154 pages.

PB–209 619

This document is comprised of the papers presented at a conference which was organized to discuss new developments and the application of computers in highway transportation, specifically in the fields of highway engineering, administration, and research. The topics covered include: Applications of interactive computer graphics; an automated roadway design system; interactive graphics applied to highway engineering; computation and plotting of highway interchanges; data base concepts; an application of computer technology to highway location dynamics; an information system for highway planning.

BEHAVIOR OF CURVED BOX BEAM BRIDGES

University of Maryland, Civil Engineering Department. Yau-shian Ho, and Robert J. Reilly. June 1971. 63 pages.

PB–209 888

This report is intended to provide engineers with information that will assist them in the design of curved box beam highway bridges. The data presented will allow the engineer to avoid making certain "exact" analyses that are usually required in the design process. Specifically, two important design parameters are provided: (1) lateral load distribution factors, which are used to describe the proportion of wheel loads to a given girder; and (2) modification factors, which are used to determine the induced bending and torsional forces relative to the maximum simple beam movement on a straight girder. The design of a typical curved box beam bridge is presented in detail.

SEALERS FOR LONGITUDINAL JOINTS

New York State Department of Transportation, Engineering Research and Development Bureau. William M. McCarty, David R. Brewster, and J. G. Fred Hiss, Jr. April 1972. 56 pages.

PB–210 045

Joints in rigid pavements are constructed to allow for expansion and contraction of concrete with changes in temperature and moisture content. Once constructed, some means of sealing them is necessary to prevent the intrusion of incompressible materials and water. In many cases, premature pavement failures can be traced to failed joint sealers. This report provides the results of an investigation which had as its purpose the determination of the most economical sealing material for longitudinal joints in rigid pavements. The results indicate that preformed compression seals give the best overall service and are probably the most economical in the long run. Neoprene and ethylene propylene copolymer performed equally well in this respect, with the latter being less expensive. A number of liquid sealing compositions also proved to have satisfactory performance. These include polyurethane, polysulfide, and hot-poured rubber-asphalt sealers.

DESIGN DATA FOR CURVED BRIDGES

University of Maryland, Civil Engineering Department. C. P. Heins, Jr. March 1972. 75 pages.

PB–210 206

Highway Engineering
(continued)

Traditionally, the location of highway bridge structures is selected at the most convenient site, with the alignment of the highway system predetermined by this selection. There are occasions, however, when the bridge engineer is required to design a bridge to fit the highway alignment. In order to fulfill this requirement and to have a structure pleasing to the eye, the structures should be curved; this requires analysis and design information for the engineer. This document provides a summary of such information which has been generated as a result of a research program which was initiated in 1968. These data involve impact factors, force equations, distribution factors, torsional properties, skew support effects, and ultimate load factors.

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NONDESTRUCTIVE DETERMINATION OF PAVEMENT THICKNESS USING ELECTRICAL RESISTIVITY TECHNIQUES

South Dakota School of Mines and Technology. James E. Russel, Thomas K. Oliver, and Paul F. Gnirk. April 1972. 76 pages.

PB–210 245

The thickness of new concrete pavement is currently determined by cutting cores and measuring their length. The major disadvantages of this method are: the method is destructive, the expense is quite high, and only a spot check of the pavement thickness is obtained. A resistivity system for thickness measurement in new concrete is described which is nondestructive and relatively inexpensive. In addition, it offers the possibility of measuring fresh concrete at a field site; this has a rather unique advantage in that the thickness of the concrete can be corrected immediately if it does not meet specifications. The system does not require the use of highly trained technicians for its operation.

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Housing and Urban Technology

MODELS OF INDUSTRIAL POLLUTION CONTROL IN URBAN PLANNING

Rand Corporation. Dennis P. Tihansky. January 1972. 48 pages.

AD–742 401

A rational evaluation of the manifold social and economic forces resulting from the urban explosion throughout the world can be attained by the adaptation of modeling and systems analysis techniques. The development and perfection of analytical tools to identify and measure relevant urban factors is necessary to gain a better comprehension and to devise meaningful policies on environmental quality control. This paper formulates models to predict the consequences of air and water pollution discharge regulations on the development of a regional economy. Concern is primarily with pollution from industrial sources, but the method of approach and techniques to solve the models can be generalized to include non-industrial sources.

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MEASURING THE EFFECTIVENESS OF LOCAL GOVERNMENT SERVICES. SOLID WASTE COLLECTION

Urban Institute. Louis H. Blair, Harry P. Hatry, and Pasqual A. Don Vito. October 1970. 44 pages.

PB–209 803

In recent years, great strides have been made in the art of management, but many of the new methods have not yet been adapted for use by local governments. This report is the first of a projected series designed to help bridge this gap. It focuses on a single local government problem—solid waste collection. A number of straightforward measures are set forth for estimating the effects of solid waste collection services and, also, the effects of uncollected solid wastes. These measures deal specifically with health and safety, aesthetics, convenience, and overall perceived public satisfaction. The scope and limitations of each measure is discussed. Recommended procedures are suggested for collecting data on the proposed measures. In some instances the measures may generate better management control of day-to-day operations. But the primary objective of the report is to improve solid waste collection programs and policies as one aspect of building better communities.

REGIONAL HOUSING PLANNING. A TECHNICAL GUIDE

American Institute of Planners; and Hammer, Greene, Siler Associates. March 1972. 132 pages.

PB–209 961

This document represents an effort to suggest a specific format or the analysis of housing needs, the setting of housing goals, and he fostering of housing action at the local or regional level. Its nain emphasis is on the analysis and forecasting of requirements or new housing production on a regional basis. A discussion is rovided of the setting in which regional housing planning is conlucted and the basic issues it should address. The suggested nalytical approach is then described. This approach is referred o as "the Housing Model", a term which expresses the intent o form a systematic expression of housing conditions and needs n a series of interrelated tables. Various types of housing objecives are described, and consideration is given to the programnatic activities of "action tools" that regional agencies and local overnments may consider in developing housing programs.

ESTIMATING HOUSING ASSISTANCE REQUIREMENTS AND SUBSIDY COSTS

Department of Housing and Urban Development, Office of Interational Affairs. Richard Metcalf. June 1972. 58 pages.

PB–209 963

Planning of housing programs and urban development, to be effective and viable, must be closely linked to national growth policies and must be based on sound projections of long term housing needs. This study describes a methodology for estimating the number of families living in substandard housing and the cost of assisting families bridge the gap between what they can afford to pay for decent housing and the economic cost of such shelter. Specific topics include: Household estimates and projections; family income estimates; prices of houses and rents families can afford; number of families to be served by housing requirements; family income and housing cost projections; and estimated cost of subsidizing one hundred units of assisted housing.

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PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON LOWER-COST HOUSING PROBLEMS

University of Missouri—Rolla Extension Division; and National Science Foundation. Oktay Ural (Editor). April 1972. 266 pages.

PB–211 437

These proceedings include over 60 papers which were presented at a symposium which was held in St. Louis, Missouri, 24–26 April 1972. The purpose of the symposium was to generate concern about the housing problems around the world as they exist today, and to exchange and extend knowledge of modern technology as applied to the housing industry. Its theme was the application of the Integrated Systems Approach towards the total solution of the housing needs of the world. The papers are concerned with every phase of housing technology and production, and are arranged with a continuity of subject matter.

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NOISE ASSESSMENT GUIDELINE

Bolt, Beranek and Newman, Incorporated. T. J. Schultz, and Nancy M. McMahon. August 1971. 38 pages.

PB–212 350

The report presents guidelines which a person without technical training can use to assess the exposure of a housing site to present and future noise conditions. The assessment includes an evaluation of three major sources of noise: aircraft, roadways, and railways. The evaluation is given in terms of level of acceptability.

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HOUSING AND URBAN DEVELOPMENT IN THE PHILIPPINES

Agency for International Development. Bernard Wagner. January 1968. 87 pages.

PB–212 371

This document is comprised of a series of papers concerning housing and urban development problems in the Philippines. Their topics include: Housing needs and a proposed action program; observations on urban development in Mindanao; suggestions for reorganization of the Home Financing Commission; suggestions for the modification of the existing structure of the administration of housing and urban development programs in the Philippines; the squatter problem; proposal for feasibility on urban planning of the Iligan area; urban development in the Philippines with special reference to housing of middle and lower income groups; housing investment by insurance companies; comments on the Draft Administrative Code as it relates to planning and housing.

LEADER TRAINING FOR AIDED SELF-HELP HOUSING

Agency for International Development. June 1969. 41 pages.

PB–212 372

Aided self-help housing is the natural way to better homes in the less industrialized areas of the world. It is a technique which may be employed for stimulating the people who live in these areas to improve their own environment. The people and communities that stand to benefit from guidance in the technique of aided self-help housing can often be reached most effectively through trained local leaders. Therefore, it is the purpose of this manual to present material useful for conducting a course for such local leaders. The following topics are included: The fundamental definition of aided self-help housing, and the various types and degrees of possible aid; advantages and disadvantages of this technique for producing homes; examples and case studies demonstrating how aided projects have been carried out by others; various planning principles affecting aided self-help housing; development of skills in construction techniques which may be used in building low-cost houses; material, labor, and financial resources; problems of communicating ideas; proposals for initiating an aided self-help housing program.

ENGINEERING DESIGN HANDBOOK. EXPERIMENTAL STATISTICS. SECTION 2. ANALYSIS OF ENUMERATIVE AND CLASSIFICATORY DATA

Army Materiel Command. December 1969. 74 pages.

AD–865 422

ENGINEERING DESIGN HANDBOOK. EXPERIMENTAL STATISTICS. SECTION 3. PLANNING AND ANALYSIS OF COMPARATIVE EXPERIMENTS

Army Materiel Command. December 1969. 93 pages.

AD–865 423

ENGINEERING DESIGN HANDBOOK. EXPERIMENTAL STATISTICS. SECTION 4. SPECIAL TOPICS

Army Materiel Command. December 1969. 109 pages.

AD–865 424

ENGINEERING DESIGN HANDBOOK. EXPERIMENTAL STATISTICS. SECTION 5. TABLES

Army Materiel Command. December 1969. 97 pages.

AD–865 425

This handbook is intended as a guide and ready reference fo
those who have responsibility for the planning and interpreta
tion of experiments and tests relating to the performance of equip
ment in the design and development stages of production. Sectio
1, which is currently unavailable, is an elementary introductio
to basic statistical concepts, such as might be taught in a fir
course in statistics. Given this basic knowledge on the part of th
user, however, the remaining sections may be used independentl
of Section 1 and of each other. Section 2 covers: Characterizin
the qualitative performance of a material, product, or proces
comparing materials or products with respect to a two-fold class
fication of performance, and with respect to several categori
of performance; and sensitivity testing. Section 3 covers: Gener
considerations in planning experiments; factorial experiment
randomized blocks, latin squares, and other special-purpose d
signs; and experiments to determine optimum conditions or level
Section 4 includes: Short-cut tests for small samples from norm
populations; tests which are independent of the form of the di
tribution; treatment of outliers; place of control charts in exper
mental work; statistical techniques for analyzing extreme-valu
data; use of transformations; relation between confidence interva
and tests of significance; expression of the uncertainties of fin
results. Section 5 is comprised of all of the mathematical tabl
needed for application of procedures in the preceeding section

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ENGINEERING DESIGN HANDBOOK. ENVIRONMENTAL SERIES, PART ONE. BASIC ENVIRONMENTAL CONCEPTS

Army Materiel Command. October 1969. 136 pages.

AD–866 476

Applied environmental studies draw heavily upon various classical sciences and engineering disciplines for an understanding of phenomena involved and solutions to problems of environmental exposure. This handbook consolidates into one place information generated by these diverse disciplines for the use of those concerned with the design of equipment to withstand the probable stresses resulting from exposure to various environmental forces. It covers both natural and artificial environments which are likely to be encountered and which are important because of their possible adverse effects. The subject areas covered include: The importance of environment as a design consideration; classification of environments and their characteristics; man-made and man-altered environmental factors; introduction to quantitative environmental concepts; definitions of basic environmental factors and the more common terms used to present data relative to these factors; laboratory simulation of various environmental conditions.

MAINTAINABILITY ENGINEERING DESIGN NOTEBOOK

ARINC Research Corporation. George T. Harrison, Jr. January 1970. 454 pages.

AD–866 818

Maintainability' has advanced to a recognized scientific discipline as the result of the expanding complexity of systems, particularly electronic, with attendant long repair times and high maintenance costs. This notebook provides a survey of electronic system maintainability under five spheres of influence: management, design, operations analysis, human factors, and logistics. It brings together currently available information from a practical rather than theoretical viewpoint. The notebook is intended to provide qualitative and technical data to serve as guidelines for establishing requirements and acceptability standards. The program elements discussed include: Means of selecting measures; tradeoffs between costs and effectiveness; procedures for selecting requirements; specifications, initial systems design; determination and assessment of design; maintainability prediction and design review; evaluation of contractors' programs; test programs; statistical design for decision tests; and guidelines for demonstration.

ENGINEERING DESIGN HANDBOOK. SYSTEM ANALYSIS AND COST-EFFECTIVENESS

Army Materiel Command. April 1971. 410 pages.

AD–884 151

System analysis processes are directed toward supplying decision makers with maximum information in order to help them in se lecting preferred alternatives to the attainment of a stated objective or to the formulation of new alternatives. Cost-effectiveness an alysis is the process of comparing alternative solutions to the a tainment of an objective in terms of value received (effectiveness for the resources expended (costs). This handbook provides a basi text and reference source on these subjects. It is intended for thos technical, scientific, management, and administrative personn who are responsible for preparing information, making decision or reviewing decisions made by others regarding life-cycle cos system effectiveness (availability, dependability, capability), c technical feasibility of a system or equipment in any phase in i life cycle. The topics covered include: An introduction to the con cept of system analysis and cost-effectiveness; a basic framewor or general methodological approach, for conducting and reviewin cost-effectiveness or system analysis studies; a set of techniqu that can be used for performing cost-effectiveness and system an alysis studies; and a review of the basic mathematical and statistic concepts that underlie the scientific approach in the system an alysis/cost-effectiveness process.

TECHNICAL PAPERS PRESENTED AT PRACTICAL INDUSTRIAL ENGINEERING WORKSHOPS

West Virginia University, College of Engineering; and America Institute of Industrial Engineers. August 1971. 211 pages.

PB–211 110

The Practical Engineering Workshops, which were held in Hun ington, West Virginia, were designed to provide direct assistan to practitioners of the industrial engineering profession. Th papers presented, and which are included in this document, dea with the following subjects: Human factors engineering, enginee ing economy, forecasting methods, and project management pr cedures. All of the papers were prepared with the objective providing the industrial engineer with information and techniqu which would be of immediate benefit on the job.

PROCEEDINGS OF THE TWENTY-SECOND ANNUA INDUSTRIAL ENGINEERING CONFERENCE, 1971

West Virginia University, Department of Industrial Engineerin February 1972. 71 pages.

PB–211 116

Six papers which were read at the Industrial Engineering Co ference are presented in this document. Their topics are: Develo ing employee achievement motivation; organization objectives an pay system goals; better management through effective commu ication; the role of the industrial engineer in air pollution contro the industrial engineer and organizational inefficiency; maintenan management.

FLUERICS—A BIBLIOGRAPHY. REVISION "B"

Harry Diamond Laboratories. Vondell Carter, and Davis S. Marsh. April 1972. 479 pages.

AD–743 800

This bibliography of the literature in fluerics and fluidics technology contains approximately 782 annotated references to articles, books, and papers, and approximately 538 descriptions of patents and disclosures. Also included are titles of papers pubished in the proceedings of all major symposia held since 1963. Subject, personal author/inventor, and corporate author/sponsor ndexes are provided. This report supersedes AD–733 300, which was announced in the July 1972 issue of AMTID, page 44.

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METHODS OF MEASURING THE MECHANICAL BEHAVIOR OF WIRE ROPE

Naval Research Laboratory, Ocean Technology Division. D. A. Milburn, and N. J. Rendler. July 1972. 29 pages.

AD–745 737

The document is concerned with precision measurement of wire ope for marine technology. Techniques are discussed for dealing with load, elongation, and torque during an axial static mode of ensile loading. A tension-torque transducer is described for simltaneous but independent measurement of applied load and inuced torque, along with an electro-optical tracking system adapted or use as a rope extensometer.

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EFFECTIVE TOOLING DESIGNS FOR PRODUCTION OF PRECISION FORGINGS

Battelle Columbus Laboratories. James R. Becker, James R. Douglas, and Fred A. Simonen. April 1972. 106 pages.

AD–745 991

Die failure has been a common problem in many attempts to preision forge strong alloys. The dies fail either by distorting seerely, as in the case of softer die materials, or by cracking, as in he case of harder die steels. Effective engineering procedures ave now been established for designing and assembling tooling or the production of nonsymmetrical precision forgings from eels and superalloys. It was demonstrated that, through the use f applied restraint to the dies, conventional that, through the use f applied restraints to the dies, conventional die materials can e used for precision forging dies where die pressures approach 0,000 psi. Finite-element analysis can be used to determine the resses in a nonsymmetrical die shape, and this analysis may be onfirmed by physical modeling. Physical modeling can also be sed to establish the preform design by forging Plasticine in a clear acrylate plastic die and by forging Plasticine and lead in the actual forging dies. It was also demonstrated that high-speed hydraulic presses can be used to make precision forgings from steels and superalloys.

TRANSDUCER APPLICATIONS—A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1972. 37 pages.

N72–23467

NASA research and development efforts have resulted in a large number of new and improved transducers which may be of interest outside the aerospace industry. This compilation describes a number of these, grouped according to the following major application categories: Thermal measurements, liquid level and fluid flow, pressure transducers, stress-strain measurements, acceleration and velocity, displacement and angular rotation, and transducer test and calibration methods. A form is provided for requesting detailed technical information on individual devices and techniques.

A PRACTICAL SOLUTION TO THE THERMAL STABILITY PROBLEM IN MACHINE TOOLS

University of California, Lawrence Livermore Laboratory. J. B. Bryan, R. R. Donaldson, E. R. McClure, and R. R. Clouser. December 1971. 25 pages.

UCRL–73577

There are two major advantages to attaining thermal stability in machine tools: (1) increased accuracy of the process in question, and (2) improved repeatability of the process. An attractive method for attaining thermal stability involves operating a machine within a suitable enclosure and showering the machine with a temperature-controlled liquid. This report describes an application of this concept to a particularly demanding case of a high precision diamond turning machine. The results show that the liquid shower approach can be engineered to provide a simple, practical system having a dramatic improvement in thermal stability and substantially lower cost than the room air conditioning system that it replaces.

Marine Engineering

EVALUATION OF BOTTOM BREAKOUT REDUCTION METHODS

Naval Civil Engineering Laboratory. K. D. Vaudrey. April 1972. 32 pages.

AD–743 880

In marine salvage, a major problem occurs during the retrieval lift operation. Certain bottom sediments create a “mud suction” on the embedded object. This suction, or breakout force, can be many times the weight of the submerged object. (A method of predicting this force is given in report no. AD–740 751; see AMTID, October 1972, page 67). This report describes an evaluation of three proposed methods of reducing the breakout force: (1) mud suction tubes, (2) water flooding, and (3) air jetting. An assessment and description of diver handling techniques is also provided. In general, it was found that all three methods are effective at reducing the breakout force to less than 10% of the wet weight of the object.

GROINS: AN ANNOTATED BIBLIOGRAPHY

U.S. Army Corps of Engineers, Coastal Engineering Research Center. J. H. Balsillie, and R. O. Bruno. April 1972. 253 pages.

AD–743 942

A groin is a shore protective structure built (usually perpendicular to the shore) to trap littoral drift or to retard erosion of the shore. Considering all types of shore protective structures used by coastal engineers, the groin is the most controversial and most difficult to design. This bibliography is intended to provide a ready source of published information on groins and groin-like structures. Four-hundred and sixty-three articles, published since 1900, are referenced. Appropriate annotations are provided with most of the entries to assist the investigator. Cross-referenced indexes for subject, author, and title are included.

BIBLIOGRAPHY ON POWER BOAT DESIGN

Joseph G. Koelbel, Jr. February 1971. 241 pages.

AD–743 964

The purpose of the bibliography is to provide the architect for mall marine craft with a current listing of reference materials on the design and construction of power boats. Certain areas are pecifically, excluded, the most important of which are sailboats, air cushion or surface effect craft, and hydrofoil craft except for hull design. There are 28 subject categories, ranging from maerials through hydrostatics and mechanics to structural parts, sysems, and performance. There are materials on small displacement craft such as fishing vessels and coasters. The structural esign of planning hulls is emphasized, and much attention is iven to tracing the development of the art. The bibliography is artially annotated. Value indexes are applied as a somewhat arbitrary judgment of frequency of usefulness to the architect. There re over 1,000 references, many of which are annotated.

GUIDE TO POWER BOAT DESIGN

oseph G. Koelbel, Jr. February 1971. 52 pages.

AD–743 966

An outline is made of the present state-of-the-art in small craft esign, intended for the practicing boat designer. A secondary im is to cover areas in which little design information is currently available. The bibliography and discussion covers materials on

Marine Engineering
(continued)

the hydrodynamics of unsymmetrical planing, maneuvering, including the prediction of turning radius at any speed, and the exact prediction of rudder sizes. Other topics treated are wake properties and estimation, resistance and trim at hump speeds, shallow water effects, vibration—particularly from propellers, structural analysis, and the calculation of hull loadings. Especial attention is given to hydrodynamics of the hull and to the prediction of performance. Computer programs available for use in power boat design are noted.

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A GLOSSARY OF COASTAL ENGINEERING TERMS

U.S. Army Corps of Engineers, Coastal Engineering Research Center. Richard H. Allen. April 1972. 61 pages.

AD–744 804

A glossary of English language terms used by coastal engineers is presented. With increased interest in coastal engineering, new terms continually appear, so that updating the vocabulary periodically is needed. The terms apply to a variety of subjects, such as waves, tides, littoral processes, shore protection, shore structures, and coastal geomorphology. Primary sources are cited. Some tabular and graphic presentations are also included.

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WORLD ATLAS OF COASTAL BIOLOGICAL FOULING. PART I: NORTH AMERICA, SOUTH AMERICA, ICELAND, AND GREENLAND

Naval Oceanographic Office. September 1970. 100 pages.

AD–876 324

This atlas provides a source of information on the extent of coastal fouling in the Western Hemisphere by marine organisms, by defining those which significantly contribute to biological fouling, their substrate attachment time periods, and their abundance relative to the total fouling community within a given geographical area. The atlas is also intended to serve as a continuous biofouling prediction manual for those coastal areas where fouling data are either sparse or absent. Specific biofouling locations, general areas, and severity are indicated on regional charts, with numerical and alphabetical area notations. Ten major groups of organisms are included: algae, amphipods, anemones, barnacles, bryozoans, hybroids, molluscs, sponges, tubeworms, and tunicates.

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Manufacturing Methods

HYDROFORMING METAL FOILS

Monsanto Research Corporation, Mound Laboratory. W. C. Wyder. June 1972. 17 pages.

MLM–1926

The forming of thin metal foils by any deep drawing technique is quite difficult. However, the hydroform process (also known as rubber-diaphragm forming) appears to lend itself to the forming or deep drawing of foils quite readily. This document provides a general description of the process, and then gives a detailed description of experience with hydroforming hemispherical shells of 0.002 inch thick molybdenum and 0.005 inch thick Mo 46–Re alloy.

SPUTTERING—A VACUUM DEPOSITION METHOD FOR COATING MATERIAL

National Aeronautics and Space Administration, Lewis Research Center. T. Spalvins. 1972. 18 pages.

N72–24529

Sputtering is a coating method which involves accelerating inert gas ions toward a target of some coating material, where atoms of that material are knocked free. A substrate placed close to the target will intercept these atoms and a film is gradually built up. This method is already widely used in the electronics industry. Other current commercial applications include the deposition of solid lubricants, of corrosion and oxidation resistant coatings, and of decorative substances. Razor blades, for example, are coated by this means for lubrication purposes and to render them more corrosion and abrasion resistant. The growing interest in sputtering originates from the fact that a great many solid materials—conductors, semiconductors, insulators, and even some organics—can be deposited in the same composition as thin adherent films. This document describes the sputtering mechanisms and the unique features of the process, and the characteristics which can be expected from sputtered films are discussed. Also, examples are given of the effects of severe friction and tensile testing an sputtered films.

SPUTTERING AND ION PLATING

National Aeronautics and Space Administration, Technology Utilization Office. 1972. 182 pages.

N72–25470

This document is comprised of papers presented at a conference held at NASA Lewis Research Center, 16 March 1972. The conference was organized to transfer an awareness of new technology in the area of sputtering and ion technology, together with indications of potential applications. The papers provide an overview of the field, a treatment of concepts, new technology developments, industrial-commercial applications, and equipment availability. Some of the specific topics include: Characteristics of ion plated films, including mechanical properties and lubrication; fundamentals of rf and dc sputtering; use of sputtering for deposition of solid film lubricants; deposition of metal and alloy coatings by electron-beam ion plating; industrial potential ion plating and sputtering; industrial sputtering for better decorative coatings; availability of commercial ion plating equipment; and some properties of a coaxial rf diode sputtering system.

ELECTROSTATIC SEPARATION OF GRANULAR MATERIALS

Bureau of Mines, College Park Metallurgy Research. F. Fraas. 1962. 156 pages.

PB–209 921

Electrostatic methods are used to separate and concentrate or purify granular particles derived from ores or various synthetic and agricultural products. Compared with other separation methods that require many technological refinements, the electrostatic attraction of fibers, grass, and seeds to charged surfaces can be accomplished under the most primitive circumstances. This publication describes the development of the electrostatic method of particle separation from the early beginning to the time of publication. Topics include: Factors related to the production of contact electrification charges; design of equipment; probability and selectivity in electrostatic separation; effect of dielectric constant; surface cleaning and filming; effect of humidity; effect of temperature; effect of impurities; size limits, classification, and separation of fine powders; applications to mineral products and agricultural industry products; cost estimation; development of electrostatic separation technology. Although the report is over 10 years old, the research it describes is basic and sufficiently valid to still be of interest.

SIX LEADING-EDGE DECKBOARD DESIGNS FOR NAILED WAREHOUSE PALLETS

Virginia Polytechnic Institute, Wood Research and Wood Construction Laboratory. E. George Stern. April 1972. 19 pages.

PB–210 796

Standardization in the field of warehouse pallets increases in importance with the increase in the production of such pallets. On the other hand, variations in design can be helpful to the pallet manufacturers, since they may be able to produce one variation versus another on a more competitive basis. This document gives the results of slight design variations on the performance of otherwise standardized pallets. These variations consist primarily of the relative widths of the first two top deck boards and the first one or two bottom deck boards. The material requirements are the same for each design, yet the number of deckboards to be produced, handled, and fastened varies from 16 to 19 depending on the design. Graphic and tabular displays of performance data permit the producer to select the least expensive design which will meet his performance requirements.

THE ADHESION OF VACUUM DEPOSITED FILMS

Dow Chemical U.S.A., Rocky Flats Division. Duane G. Williams. July 1972. 21 pages.

RFP–1690

The adhesion of thin films to substrates has always presented a serious problem in the field of vacuum deposition. The report reviews some of the major inherent difficulties encountered and provides data on the current status of work effects. Data are included on the adhesion of sputtered and evaporated films to oxide, metal, and other substrates, and also methods of testing. Background information in related fields, particularly solid-phase welding, is summarized. Consideration is also given to adhesion theories and problems currently hindering theoretical treatment of the interface between film and substrate. A bibliography of 95 entries is included.

ION PLATING—CONCEPTS AND APPLICATIONS

Sandia Laboratories (AEC). D. M. Mattox. 1971. 37 pages.

SC–DC–721128

Ion plating is a term applied to a film deposition process in which the substrate is subjected to a flux of high energy ions sufficient to cause appreciable sputtering before and during film deposition. From the standpoint of adhesion, the principal benefits are: It cleans the surface and maintains it clean until the film begins to form; it heats the surface without heating the rest of the substrate, thus promoting diffusion, chemical reactions, etc.; it physically mixes the film and substrate, and influences the growth of the film. Ion plating has been used to effect the deposition of metals, alloys, and compounds on metal, insulator, and organic substrates. Specific applications have ranged from the formation of contacts for semiconductors to applying corrosion-resistant coatings to screws and bearings. This document outlines the fundamental concepts of ion plating, discusses the process in terms of equipment and techniques, and describes some of the applications that have been developed. A fairly comprehensive bibliography is included.

Metrology

FREQUENCY STANDARDS AND CLOCKS: A TUTORIAL INTRODUCTION

National Bureau of Standards, Time and Frequency Division. Helmut Hellwig. April 1972. 72 pages.

COM–72–50525

The subject of frequency standards and clocks is reviewed in a nonmathematical way. The concepts of time, frequency, frequency stability, and accuracy are introduced; and the general physical principles and design features of frequency standards and clocks are described. The design, performance, and limitations of quartz crystal oscillators and atomic resonance devices are discussed in detail. A critical comparison is provided for available and proposed frequency standards for laboratory and field usage.

Metrology
(continued)

PRECISION MEASUREMENT AND CALIBRATION. VOLUME 9. COLORIMETRY

National Bureau of Standards. Isadore Nimeroff (Editor). June 1972. 460 pages.

COM–72–50697

This book deals with the analysis and interpretation of precision measurement data in the field of colorimetry. It is a compendium of work in this field published during the period from 1954 to 1968 by personnel of the National Bureau of Standards. The 37 papers included fall into the following subject areas: spectrophotometry, color vision, color specification and order systems, light sources and color instrumentation, color spacing and metamerism, variabilities and uncertainties in colorimetry, and appearance and gloss.

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MEASUREMENT TECHNOLOGY

National Aeronautics and Space Administration; and Small Business Administration. 1972. 37 pages.

N72–25421

A number of measurement techniques developed by or for NASA have potential for application in small industries outside of the aerospace area. This document briefly describes a number of such techniques, and provides a means for requesting additional detailed technical information on individual techniques. The general subject areas covered include: Surface measurement; alignment and orientation of bodies; fluid measurement; linear and angular measurements; and force measurement. Most of the techniques described are not subject to patent restrictions.

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Mining Engineering

A CURRENT APPRAISAL OF UNDERGROUND COAL GASIFICATION

Arthur D. Little, Incorporated. April 1972. 280 pages.

PB–209 274

The basic difference between conventional mining and underground gasification of coal deposits is the location at which the coal's energy is extracted. Conventionally, coal is mined underground and brought to the surface before its heating value is recovered. In underground gasification, the heating value is extracted *in situ* from the coal deposit and brought to the surface in the form of combustible gases. Underground gasification has potential advantages in that it eliminates the safety and health hazards implicit in conventional underground mining, and it may improve utilization of coal resources, particularly with respect to lower rank coals. This report provides background information relevant to an appraisal of the feasibility of underground coal gasification, a review of the current state of the technology (including a survey of the post–1960 technical and patent literature), an evaluation of opportunities for further research and development, and a review of technology in related areas where recent developments have a bearing on underground gasification.

NUMERICAL METHODS FOR DETERMINING STREAMLINES AND ISOPRESSURES FOR USE IN FLUID-FLOW STUDIES

Bureau of Mines, San Francisco Energy Research Laboratory. R. V. Higgins, and A. J. Leighton. April 1972. 66 pages.

PB–209 537

The use of isopressures (or isobars) and streamlines in flow of fluids and electricity has been most useful in the past. These lines have been determined either by sophisticated mathematical methods for uniform patterns or by electrical techniques for uniform configuration. In oilfields the patterns often are not symmetrical, which presents special problems. A computer method is presented in this document which permits the calculation of streamlines and isopressure lines for an oilfield from the pressure distribution as determined from existing wells. The method reproduces the flow net for several well configurations having extensive geometrical variations. Such information provides the petroleum engineer with data from which he can compute oil recoveries for different patterns and thereby maximize the recovery of hydrocarbons from the reservoir. The method also has application to the determination of the flow of water in aquifers. Computer program listings and flow diagrams are included.

SELECTED LIST OF BUREAU OF MINES PUBLICATIONS ON PETROLEUM AND NATURAL GAS, 1961–70

Bureau of Mines, Bartlesville Petroleum Research Center. V. Vern Hutchison. April 1972. 168 pages.

PB–209 546

A selected bibliography of 829 entries provides a review of the Bureau of Mines publications related to petroleum and natural gas during the period 1961 to 1970. Included are works on drilling methods and materials, petroleum fields, chemical constituents and properties, thermodynamic properties of hydrocarbons and mathematical treatments, natural gas research and handling, environmental factors in the petroleum industry, general information on various geographic locations, statistical data, patents, and libraries.

DEVELOPMENT OF A BOREHOLE DEVICE TO DETERMINE THE MODULUS OF RIGIDITY OF COAL MEASURE ROCKS

Colorado School of Mines. William Hustrulid. March 1972. 130 pages.

PB–209 548

The field of rock mechanics is of high importance to mining engineering, particularly with regard to the effective modulus of rock rigidity and Young's modulus. Past methods of determining these moduli have been either inadequate or expensive in scale tests or at mine suites. The report discusses a pressure cell of adiprene membrane evolving from a cylindrical copper pressure cell recently developed. It may be inserted in a blowhole drilled in a mine location, filled with a pressurizing liquid until it contacts the wall of the blowhole, and used to obtain the desired modulus data from recorded pressure-volume relationships. Design and construction of the membrane are described, along with problems encountered. A mathematical analysis is given, followed by details of laboratory testing of the cell. Much of the data is presented graphically.

GROUTING OF HORIZONTAL HOLES IN COALBEDS

Halliburton Services. March 1972. 40 pages.

PB–209 575

Horizontal holes are drilled underground in coalbeds to control methane flow and to make gas pressure measurements. Gas pressure measurements are made by drilling the same hole incrementally. After each increment, the hole is filled with some type of packer and allowed to reach equilibrium before a gas pressure reading is taken. Problems have been encountered in obtaining satisfactory packer seals due to the friable nature of the coalbed. This report provides the results of an evaluation of new types of packer materials and placement techniques. A rigid grout comprised of a salt-saturated portland-gypsum-cement blend was found to be satisfactory. A number of recommendations for placing borehole packers are provided.

SUMMARY OF MINING AND PETROLEUM LAWS OF THE WORLD. 3. NEAR EAST AND SOUTH ASIA

Bureau of Mines. Northcutt Ely. 1972. 87 pages.

PB–211 100

This document is comprised of condensed versions of the mining and petroleum laws of 22 jurisdictions of the Near East and South Asia. Within these jurisdictions, primary attention is given to requirements that must be met in each country for acquisition rights to permit development of mineral resources. In countries where minerals are subject to control by states or provinces, those areas are considered separately from the central government. The jurisdictions covered are: Afghanistan, Bahrain, Ceylon, Cyprus, Egypt, India, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Nepal, Oman, Pakistan, Qatar, Saudi Arabia, Southern Yemen, Syrian Arab Republic, Turkey, United Arab Emirates, and Yemen. A previous report in this series (PB–198 256), covering the Western Hemisphere, is described in the April 1972 issue of AMTID, page 88.

MINERALS YEARBOOK, 1970. VOLUME I. METALS, MINERALS, AND FUELS

Bureau of Mines. Elburt F. Osborne (Editor). 1972. 1204 pages.

PB–212 185

This yearbook provides a statistical record on the world's mineral industry performance during 1970, and contains sufficient background information to interpret the year's developments. It contains individual sections on about 100 mineral commodities of economic importance. Each section includes data on worldwide production, consumption and uses, prices, international trade, and technology. In addition, the book provides a general review chapter on the mineral industries, a statistical summary, and chapters on employment and injuries and on technological trends.

Nondestructive Testing

ACOUSTIC EMISSION AND FRACTURE MECHANICS TESTING OF METALS AND COMPOSITES

University of California (Los Angeles), School of Engineering and Applied Science. A. S. Tetelman. July 1972. 46 pages.

AD–746 261

Acoustic emission testing (AET) technology has grown in parallel with increase in understanding of plastic flow and crack propagation in structural materials. Since AET is the only known method of non-destructive testing which can measure the rate of slow crack growth in fatigue or describe the conditions for the onset of unstable crack propagation, it is important to the prevention of failure in large structural systems. The report reviews some of the principal correlations between AET and the processes of flow and fracture in structural materials. It describes the macroscopic processes of slow crack growth and the onset of fast crack propagation. Some first order approximation mathematical models are presented which await confirmation.

A REVIEW OF NONDESTRUCTIVE METHODS FOR THE DETECTION OF CONCEALED CRACKS

General American Transportation Corporation. H. W. Kamm, and . R. Kraska. July 1971. 20 pages.

AD–746 268

Nondestructive Testing
(continued)

This report reviews and evaluates nondestructive crack detection methods, with particular attention given to their use in the field to detect cracks in metal structures which are concealed by fasteners, painted surfaces, and protective coatings. Nondestructive methods for these applications are classified as recommended, potentially applicable, and inapplicable. Ultrasonics and eddy current techniques are the recommended methods; acoustic impact, acoustic emission, and non-film x-ray imaging are considered potentially applicable; and holography, visual, liquid penetrant, magnetic thermal, and radiography methods are classified as inapplicable A bibliography is included.

Nuclear Technology

INDEXED BIBLIOGRAPHY ON ENVIRONMENTAL MONITORING FOR RADIOACTIVITY

Oak Ridge National Laboratory (AEC), Nuclear Safety Information Center. B. L. Houser. May 1972. 326 pages.

ORNL–NSIC–101

The major points of concern for establishing an environmenta monitoring program for radioactivity seem to be the following The detrimental effects to man and his environment; the pathways by which radionuclides travel to man; and the groups most susceptible to damage from the radionuclides. This bibliography which contains over 850 abstracts, was prepared for the primary purpose of assisting in the development of criteria for such a program. The entries are arranged into six major sections: preoperational surveys; surveys at the startup of a nuclear facility; routine surveys during operation; analytical procedures; instrumentation including instrument calibration; and emergency monitoring. Subject and author indexes are included.

COMPILATION OF NUCLEAR STANDARDS. NATIONAL (EXCLUDING U.S.) AND INTERNATIONAL ACTIVITIES. 8TH EDITION, 1971

Oak Ridge National Laboratory, Nuclear Safety Information Center. J. Paul Blakely. June 1972. 153 pages.

ORNL–NSIC–102

All available national and international nuclear standards activities except for those of the United States, are presented in simple tabular form. The standards activities of all national organizations, technical societies, etc., as well as relevant regulations established by government agencies are listed in alphabetical order by country or by international organization. An index is included This document supersedes the 7th Edition, ORNL–NSIC–94 which was listed in the July 1972 issue of AMTID, page 62.

IMPROVISING ELECTRIC POWER FROM INDUCTION GENERATORS DURING PROLONGED POWER OUTAGES

URS Research Company, Environmental Systems Division. R. H. Black. September 1971. 75 pages.

AD–741 386

Large scale disasters, such as those caused by severe weather, can extensively disrupt electric power distribution and transmission systems. Induction motors are generally widely distributed and common devices that can be converted to improvised generators in such emergencies. The major components of a generator of this type may be found serving other needs in larger office buildings and in industrial facilities. These components can be temporarily and inexpensively rearranged to provide an effective improvised power plant without permanently affecting their original function. Induction generators are safe to use; a short circuit or overload does not result in damage to loads or generator components. Also, the alternating current automatically synchronizes with line frequency, so it may be used to augment the power of a limited a.c. source (for example, one or more other induction generators operating in parallel).

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ENGINEERING-ECONOMIC POTENTIAL FOR POWER PLANT WASTE HEAT UTILIZATION

Purdue University, School of Mechanical Engineering. Robert J. Faucher, and Raymond E. Goodson. May 1972. 37 pages.

AD–743 494

The modern regenerative reheat stream cycle, such as used in steam-electric power plants, is perhaps the most efficient heat engine in large scale use today. However, it is still necessary to provide a steam condensing heat sink which will dissipate 60–65% of the input energy that cannot be converted to useful work in such a heat engine. The vast amount of waste heat which must be dissipated has traditionally discharged into natural water bodies. The utilization of this waste heat could, however, provide several desirable objectives: Improved efficiency of energy resource use; reduced environmental impact due to thermal discharges; reduced artificial cooling requirements at the plant site; and improved plant economic value resulting from thermal energy sales. This report presents a quantitative mechanism which is intended to facilitate evaluation of the waste heat utilization potential of a power plant. The method uses a maximum justifiable investment concept, which is calculated using a present worth criterion and at constant thermal input to the turbine cycle. A bibliography is included on the subjects of primary energy sources, conversion systems, additional energy utilization, energy transmission, and environmental and societal concerns.

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AN ANNOTATED BIBLIOGRAPHY OF THE THERMAL PROPERTIES OF PRIMARY AND SECONDARY CELLS

Battelle Memorial Institute, Columbus Laboratories. E. W. Brooman. June 1970. 82 pages.

AD–871 108

This document provides a compilation of thermophysical and thermochemical data for electrochemical energy conversion devices (except fuel cells). The main section of the document is a comprehensive bibliography, for the period 1948 through 1969, arranged according to the following subject categories: Thermal conductivity, resistance data, and resistance-capacitance networks; specific heat and heat capacity data; enthalpy, entropy, and temperature coefficient of emf data; heat-generation prediction and measurement; thermal design of cells and batteries; environmental temperature effects on cell or battery operation and life. Each bibliographic entry is accompanied by an annotation. The quantitative data found in the literature covered are summarized in tabular form so that the properties of different cells or cell components may be compared. Subject, personal author, and corporate author indexes are included.

AGRICULTURAL AND AQUACULTURAL USES OF WASTE HEAT

Oak Ridge National Laboratory (AEC). M. M. Yarosh, B. L Nichols, E. A. Hirst, J. W. Michel, and W. C. Yee. July 1972 56 pages.

ORNL–4797

In modern generating plants electricity is produced with efficiencie ranging from about 33 to 40%. Most of the remaining energ appears as waste heat. Significant quantities of waste water ar also available from smaller energy sources such as those used fo industrial applications. The heat from these sources represent both a potential environmental pollutant and a potential energ resource. This document provides a survey of some of the possibl uses of waste heat in agriculture and aquaculture, with emphasi on that produced by steam-electric plants. Consideration is give to the application of waste heat in open-field agriculture, green houses, and animal shelters; and in maintaining optimum temperatures for the culture of aquatic organisms such as fish or shrimp In addition, some general aspects of waste heat utilization, suc as supply-demand matching, marketing, legal and regulatory problems, and site selection, are discussed.

A METHOD FOR PREDICTING THE PERFORMANCE OF NATURAL DRAFT COOLING TOWERS

Environmental Protection Agency, Pacific Northwest Water Laboratory. L. D. Winiarski, B. A. Tichenor, and K. V. Bryam. December 1970. 78 pages.

PB–210 125

Cooling towers, such as those used in conjunction with the operation of power plants and other large heat sources, are merely heat exchangers that transfer heat from water to air. A natural draft cooling tower is basically a large chimney that provides a draft to pull air over a large surface of water. The airflow is established without the expenditure of external power. This report presents a mathematical model which is capable of yielding reliable predictions of cooling tower performance at relatively low cost. Inasmuch as the state of the air leaving the tower packings is actually determined, and not merely assumed to be saturated, the results are of value in studying the effect of a tower on local atmospheric conditions. A computer program for performing the necessary calculations is included.

Resource Survey Technology

A STATE-OF-THE-ART SURVEY OF THE APPLICATIONS OF AERIAL REMOTE SENSING TO COASTAL ENGINEERING

Clemson University, Department of Civil Engineering. Donald B. Stafford. May 1972. 195 pages.

AD–744 479

This report presents an evaluation of the state-of-the-art of the applications of aerial remote sensing techniques in the field of coastal engineering. This field is considered in a broad context in an effort to include a wide variety of coastal problems, features, and phenomena. For instance, monitoring coastal changes, surveying beach erosion, examining coastal landforms, determining storm effects, mapping coastal areas, measuring currents, evaluating coastal processes, determining nearshore hydrography, and searching for and monitoring marine resources are all considered to be related to coastal engineering. The techniques covered include black-and-white and color aerial photographs, both visible and infrared; multispectral aerial photographs; satellite photographs; infrared imagery; multispectral imagery; radar imagery; and other, less common techniques. The report is comprised of both a narrative summary of the state-of-the-art, and a bibliography (with abstracts) of the pertinent literature published over a 30-year period.

REMOTE SENSING IN HYDROLOGY: A SURVEY OF APPLICATIONS WITH SELECTED BIBLIOGRAPHY AND ABSTRACTS

Texas A and M University, Remote Sensing Center. Sidney W. Sers. October 1971. 30 pages.

N72–21357

Because of the inadequacies of current surface exploration techniques for groundwater resources, a good deal of attention has been given to the possible application of airborne remote sensing, using thermal infrared detectors, as a water prospecting tool. This survey is intended to stimulate awareness of the potential of such methods. The fundamentals of remote thermal sensing are reviewed, and various applications are described. It is demonstrated that infrared sensors can locate aquifiers, geothermal water, water trapped by faults, springs, and water in desert areas. A selected bibliography, with abstracts, is included.

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BIBLIOGRAPHY OF REMOTE SENSING FOR PLANNING AND ADMINISTRATIVE STUDIES

Association of American Geographers, Commission of Geographic Applications of Remote Sensing. Nelson R. Nunnally. December 1971. 76 pages.

PB–209 633

This bibliography contains abstracts of about 170 representative publications dealing with remote sensing, with emphasis on those applications of interest in the fields of regional planning and administration. All types of sensing systems and methodologies are covered. An attempt was made to reference only the best publications on a particular topic, and to choose material illustrating various viewpoints. A subject index is included.

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URBAN AND REGIONAL PLANNING UTILIZATION OF REMOTE SENSING DATA: A BIBLIOGRAPHY AND REVIEW OF PERTINENT LITERATURE

University of Washington, Department of Urban Planning. Frank V. Westerlund. April 1972. 231 pages.

PB–211 101

The term *remote sensing* is generally applied to the use of airborne or spaceborne devices for observation and sensing of the earth. This document is concerned with remote sensing in relation to users in the field of urban and regional planning. The first part considers the data needs of planning and relates these to the technical capabilities of remote sensing. The second part is a guide to completed research pertinent to planning applications. This takes the form of a survey of literature in which related studies are identified by subject and collectively described, followed by separate annotation of selected individual papers. An extensive bibliography is included in which papers are cross-referenced according to categories of sensor-type and type of planning application.

Safety

EVALUATION OF AIRCRAFT GROUND FIREFIGHTING AGENTS AND TECHNIQUES

Federal Aviation Administration, National Aviation Facilities Experiment Center. George G. Geyer. February 1972. 257 pages.

AD–741 881

The development of larger commercial aircraft has emphasized the need for improved post-crash firefighting capabilities to effectively control the fire hazards associated with an increase in the quantity of fuel on board. This report provides the results of a program which was undertaken to study and test both current and new firefighting agents, equipment, and techniques in an effort to produce the most effective aircraft ground firefighting and rescue capabilities. Laboratory studies were conducted to ascertain the most acceptable agents and equipment, and those which survived this screening were employed in full scale tactical firefighting experiments performed with surplus jet bombers. This permitted a determination of the effectiveness of each agent and the validity of the techniques and agent application rates employed.

THE MECHANICS OF AUTOMOBILE COLLISIONS

Naval Research Laboratory, Applied Mechanics Branch. F. Rosenthal, R. L. Bort, G. J. O'Hara, E. W. Clements, and R. A. Skop. May 1972. 94 pages.

AD–743 449

There has been a great deal of concern about the large and increasing cost in lives, injury, and property damage of automobile accidents. The main body of this report provides a review of the basic mechanics of single-car and two-car collisions in terms of the conservation of momentum, and the conservation of total energy. It includes curves depicting required stopping or crash distances as a function of initial velocity and g-loading for various ypes of energy absorbing mechanisms. A comprehensive analysis s given of the mechanics of impact of a vehicle impinging on a igid barrier, and of two impacting vehicles initially traveling at arbitrary relative speeds and directions. Some suggestions are made for vehicle occupant protection measures based on the mechancial principles developed in this report. An annotated bibliography is included.

A SYSTEMATIC APPROACH TO PIPELINE SAFETY

National Transportation Safety Board. May 1972. 19 pages.

PB–210 639

The advantages of the new technology, "system safety", have been demonstrated in aerospace, aviation, and military activities. Basic principles used in system safety include the analysis of systems to identify hazards and the adoption of methods to eliminate or control these hazards. This document describes what system safety is, what its potential benefits are, and some of the methods by which it may be applied to safety in the pipeline field. Pipeline systems are particularly susceptible to advantages derived from a systematic approach to ensure an optimum degree of safety of operations because they are definable as engineering systems and may, therefore be subjected to a high degree of control.

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METHODS FOR EVALUATING EXPLOSIVES AND HAZARDOUS MATERIALS

Bureau of Mines, Pittsburgh Mining and Safety Research Center. C. M. Mason, and E. G. Aiken. 1972. 54 pages.

PB–210 966

This document is a compendium of methods currently used by the Bureau of Mines for evaluating explosives and other hazardous materials. The characteristics of concern include: sensitivity to detonation, explosive strength, incendivity, gaseous products, and physical measurement. For each method, the necessary apparatus, materials, procedure, and data treatment are described. The tests include those used to certify explosives for use in underground coal mines.

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INSTRUMENTS FOR DETECTING GAS IN UNDERGROUND MINES AND TUNNELS

Bureau of Mines, Pittsburgh Mining and Safety Research Center. B. I. Ferber, and A. H. Wieser. 1972. 20 pages.

PB–210 991

A discussion is provided of the toxic and explosive atmospheres which may be present in underground mines and tunnels. Some of the detection instruments commercially available are also described. No attempt is made to evaluate the accuracy of any one device, but rather to aid mine inspectors in selecting suitable instrument for underground gas detection.

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REPORT ON THE 1972 AID NATIONAL DISASTER PREPAREDNESS PLANNING SEMINAR. VOLUME I

Institute for Defense Analysis. John K. Moriarty, and Marjory Pickford. July 1972. 71 pages.

PB–211 327

It is generally recognized that the most effective disaster relief is that made available within the first few hours and must come from the immediate region of the disaster. Many of the countries most vulnerable to catastrophic events, however, have been precisely those least able in terms of resources or organizational preparedness to provide immediate relief for their disaster-stricken populations. This document provides a summary of a symposium which was intended to assist in the assessment and improvement in national disaster relief operation and plans, and to provide training programs for the participants. Specifically, the symposium included discussions of common problems and nationally developed solutions; reviews of basic scientific findings pertaining to disaster prevention, control, and amelioration; and briefings on methods of warning, assessing relief requirements, providing emergency relief, and rehabilitation. Representatives from Brazil, Colombia, Costa Rica, Guatemala, Honduras, Iran, Mexico, Nicaragua, Peru, the United Nations, and the Organization of American States participated, and the seminar focused on specific problems in these countries. Volume II of this report contains only administrative information concerning the organization of the seminar, and has not been made available to the public.

Seals

SEALS: A BIBLIOGRAPHY

Defense Documentation Center. June 1972. 242 pages.

AD–744 050

The bibliography compiles abstracts of reports resulting from U.S. Government funded research, for the period 1953 to 1972, on sealing mechanisms and materials. Some of the topics covered are research in dynamic sealing and in design for launching sys- ems, bearing and seal technology review, fluid seals for high speed otating equipment, shaft seals for space, hermetic seals in plastic odied connectors, gasketing media at ultra-high pressures, O-ring ging characteristics, and a vacuum seal for non-circular tubes. General headings include fuel and gas seals, gaskets, glass seals, ermetic and hydraulic seals, metal seals, oil seals and O-rings, lastic and vacuum seals, rotary seals, and rubber seals. The re- orts listed are available from NTIS.

EALS AND SEALING TECHNIQUES

Iational Aeronautics and Space Administration; and Small Busi- ess Administration. 1972. 31 pages.

72–21480

number of innovations in seals and sealing techniques developed y or for NASA have potential for application outside of the aero- pace industry. This document is a compilation of descriptions of ich devices and techniques. The general areas covered are seal- g techniques for cryogenic fluids, high-pressure applications, and

Seals
(continued)

modifications to existing types for improved performance. A form card is provided for requesting detailed technical information on the innovations described. No patent action is contemplated on most of the seals and techniques.

Soil Mechanics

STABILIZATION OF INORGANIC SILTS: PANAMANIAN SOILS

Army Construction Engineering Research Laboratory, Geotechnical Systems Branch. Raymond E. Aufmuth. April 1972. 17 pages.

AD–742 213

Soil stabilization studies were conducted on two soil types from different slide areas in Panama. In order to achieve effective stabilization, physical and chemical properties of the natural soils were determined, and selected engineering properties were evaluated for both the natural soils and those with stabilizing agents added. Both soils were effectively stabilized with lime and cement. These agents, added in optimum amounts, were found to reduce plasticity and swell, and improve the workability and strength characteristics of the soils.

STABILIZATION STUDIES: AFGHANISTAN SOILS

Construction Engineering Research Laboratory. Raymond E. Aufmoth. June 1972. 18 pages.

AD–745 408

A summary is given of a study of the feasibility of stabilizing or otherwise improving selected engineering properties of three Afghanistan soils to make them more suitable for construction purposes. The stabilizing agents used were lime and cement commercially available in Afghanistan. The three soils were all found to be reactive with lime or cement to form a stabilized soil with increased strength and durability. It was also found that the addition of lime or cement increases the resistance of the soils to moisture and ice penetration.

EXPEDIENT SURFACE SOIL SAMPLING

Army Engineer Waterways Experiment Station. S. J. Knight, and C. A. Blackmon. December 1967. 30 pages.

AD–746 350

It is sometimes necessary to obtain a sample of soil in situations where standard soil sampling equipment is not available. This document shows that, in these cases, empty metal cans may be used to collect and contain soil samples. The comparative merits of various types of cans and of the moisture-retention properties of various kinds of covers are discussed. A step-by-step procedure for collecting surface soil samples using these materials is given.

FEASIBILITY STUDY OF SOIL STABILIZATION BY SOIL MIXER

Boeing Company. Sheldon L. Austin, Walter T. Cox, Christian C. Heinrichs, and John R. Sendek. March 1969. 250 pages.

AD–850 245

A requirement exists for a technique of rapidly preparing airfield and other pavement surfaces of stabilized soil. This report describes a feasibility study of in-place stabilization of soils by the mixing of resinous, quick-curing material into the soil. It was found that polyester resin, promoted with dimethylaniline and catalyzed with benzoyl peroxide, is the most effective and the most readily controlled of the materials investigated, while accommodating variations in soil types, soil moisture content, and temperature. Stabilized soil pavement design curves are included.

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A STUDY OF THE BASIC MINERALOGICAL, PHYSICAL-CHEMICAL, AND ENGINEERING INDEX PROPERTIES OF LATERITE SOILS

Texas A and M Research Foundation. Jerome R. Pearring. May 1969. 133 pages.

AD–854 187

Laterite soils, a group of red residual soils of the Tropics, rank high among the soils least understood by civil engineers. This paper applies the processes used by soil scientists to establish the hemical and mineralogical character of soils identified as laterite, nd correlates these properties with the engineering index prop-rties in an effort to point the way to more intelligent understand-ng and usage of these materials. Significant relations were found o exist between cation exchange activity and several other prop-rties. In general, the only properties that the laterites of the world ppear to share are those imparted by their iron oxide content.

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THE USE OF LIME-SOIL STABILIZATION AS A CONSTRUCTION EXPEDIENT

Air Force Weapons Laboratory. Charles H. Neubauer, Jr. June 970. 120 pages.

AD–872 157

There are many instances when soft, highly plastic, cohesive, *in-tu* soil conditions create operating difficulties for wheeled ve-icles. In general, these conditions are associated with high soil moisture contents. In such situations not only will vehicles have ifficulty operating, but also construction equipment many be un-ble to develop adequate stability, by compaction of the subgrade, support adequate traffic. Experience has shown that treatment ith lime is an effective method of reducing *in-situ* stability prob-ms of cohesive subgrades. Little research has been directed, how-ver, toward evaluating the "uncured" or early stability character-

Soil Mechanics
(continued)

istics of lime-soil mixtures. This report gives the results of just such an investigation. It was found that a substantial gain in stability is realized by the addition of lime to fined-grained cohesive soils, and that this stability is reflected by the immediate gain in modulus of deformation and shear strength. Guidelines for a step-by-step laboratory procedure for evaluating the immediate benefits of lime-soil stabilization and an analysis procedure for predicting vehicle mobility over uncured lime stabilized subgrade are presented.

FUNDAMENTALS OF SOIL COMPACTION

Ohio State University. Kamran Majidzadeh, H. R. Guirguis, and G. S. Joseph. June 1971. 216 pages.

PB–210 567

There is an urgency for developing methods of pavement design which can predict with reasonable accuracy the effects of loading, environment and climate, properties of materials, and geometric form on pavement performance. The report considers the subgrade soil as an important component of any pavement system, and outlines as a method of evaluating the soil parameters needed in a rational pavement design procedure. The results of laboratory tests are given using various compaction methods and moisture contents. The response parameters such as creep and resilience moduli, shear strength, and failure deformation are compared to results obtained in field tests on embankments compacted by standard rollers and methodology.

Structural Engineering

THE SIGNIFICANCE OF MATERIAL DUCTILITY TO THE RELIABILITY AND LOAD CARRYING CAPACITY OF PEAK PERFORMANCE STRUCTURES

Syracuse University, Department of Chemical Engineering and Materials. Volker Weiss, Mukulesh Sengupta, and Dhirendra Lal. January 1972. 91 pages.

AD–741 712

This report provides the results of a study which was undertaken to develop criteria for peak performance structures. Such criteria are needed particularly for materials and structural configurations where failure from stress concentration occurs with some ductility and not necessarily under plane strain conditions. The studies indicate that its is possible to develop design criteria against fracture on the basis of readily determinable material parameters. These parameters are the tensile fracture strain under known multiaxial stress states, the yield strain, the yield strength, the stress-strain relation exponent, and Neuber's micro-support effect constant. The various methods available for determining the fracture strain, the stress-strain exponent, and the micro-support effect constant are described. The proposed analysis was applied to an aluminum alloy with consistent results.

FOUR BASIC TYPES OF METAL FATIGUE

George Washington University, School of Engineering and Applied Science. W. A. Wood. June 1972. 99 pages.

AD–746 121

The behavior of metallic structures under stress differs according to whether the stress is sustained (static) or repeated (cyclic). A metal which can withstand a static tension of 34,000 psi before yielding and 54,000 psi before breaking, for example, may fracture under cyclic tension-compression at 18,000 psi. Alloys fare even worse; some of them are strong under static stress only. Thus a basic problem is to determine what cyclic stress can do to a microstructure that static stress cannot. The report describes four varieties of metal fatigue: plastic, elastic, plasto-elastic, and alloy, plus a few special cases. An experimental study is also described of mechanical tests on plastic and elastic metals, and the results of microscope and X-ray tests of all four types of fatigue are discussed.

REPRESENTATION OF CREEP OF METALS

Oak Ridge National Laboratory (AEC). F. Turan Onat, and F. Fardshishen. August 1972. 129 pages.

ORNL–4783

This document constitutes a critical review of the subject of the mathematical description of creep behavior of metals for the purpose of structural analysis. "Creep" usually refers to the time-dependent deformation of materials that occurs under constant stress and temperature. In this work, however, emphasis is placed on creep behavior under unsteady loads and/or temperatures. The general topics covered include: A review of experimental evidence concerning creep in metals; a detailed discussion of representation of creep by means of state variables and the associated system of differential equations; the integral representation of creep behavior; and analysis of structures in the presence of creep.

PROCEEDINGS OF THE SECOND CONFERENCE ON THE BEHAVIOR OF CONCRETE STRUCTURAL SYSTEMS

West Virginia University, Department of Civil Engineering. February 1972. 42 pages.

PB–211 117

The second conference dealing with the fundamental behavior of structural concrete was held to informally discuss recent developments and future requirements in research for concrete structures. This report summarizes those discussions. The general topics include: The behavior of structural concrete framing systems; the behavior of structural concrete slab and plate systems; the be-

Structural Engineering (continued)

havior of structural concrete shear wall structures; the behavior of structural concrete folded plate and shell structures; the behavior of structural concrete bridge systems; and the present state-of-the-art and resulting research needs.

Transportation

THE AVIATION MAINTENANCE ENVIRONMENT IN THE 70's. SIXTH ANNUAL INTERNATIONAL AVIATION MAINTENANCE SYMPOSIUM, DECEMBER 8-10, 1970

Federal Aviation Administration. December 1970. 305 pages.

AD–746 353

This document is a compilation of papers presented at a symposium which was concerned primarily with the maintenance of aircraft in service with commercial air carriers. The topics covered include: Computer application strategy for control of airline maintenance in the 1970's; improving the readability of maintenance manuals; employment of the digital computer for aircraft maintenance; facilities, equipment and tools to support wide-bodied aircraft maintenance in the 1970's; remanufacturing of jet engine components employing brazing techniques; nondestructive inspection as an aircraft maintenance tool; maintenance fault isolation in the 1970's; improved Lockheed L–1011 fault isolation techniques; an application of modern maintenance concepts and safety analysis to the multinational certification of a supersonic transport aircraft; modular design concept for improved jet engine maintainability; accessibility as a key to good powerplant maintenance; maintaining the Beechcraft Hawker 125 aircraft in the 1970's; the general aviation maintenance outlook for the 1970's; projected maintainability advantages of solid state electrical power management and solid state contactless switching systems; Pacific Airmotive Corporation accessory reliability program (PACAR).

A STATISTICAL ANALYSIS OF THE WORLD'S MERCHANT FLEETS

Maritime Administration. 1972. 145 pages.

COM–72–50354

This document is comprised of tables showing the number, year built, speed, draft, and gross tonnage of the ocean-going ships of the merchant fleets of the world. It is arranged in sections according to general ship type (combination cargo-passenger, freighters, bulk carriers, and tankers), and within each section the data tables are arranged according to country. Military vessels and special types (cable ships, icebreakers, trawlers, etc.) are excluded. The data are current as of 31 December 1970.

SOCIAL IMPACTS OF CIVIL AVIATION AND IMPLICATIONS FOR R&D POLICY

George Washington University, Program of Policy Studies in Science and Technology. Louis H. Mayo. September 1971. 233 pages.

N72–23973

This report summarizes the results of a study which was undertaken to identify social impacts, both beneficial and detrimental, which could flow from introduction of advanced civil aviation systems. The range of impact areas investigated in this technology assessment included economic, environmental, political, sociological, psychological, legal, and urban/regional developmental factors. Some of the technology covered involves short-haul interurban air transportation systems, airports for short-take-off-and-landing aircraft, effects on the natural environment, aircraft noise, and airport access.

AN ECONOMIC MODEL OF CARGO LOSS

Braddock, Dunn and McDonald Incorporated. May 1972. 85 pages.

PB–210 223

The report is concerned with the economic impact of cargo loss to all modes of transportation, to large and small businesses, and to the public, particularly with respect to losses from theft and pilferage. An analysis is made of causes and sources of cargo loss, in order to develop effective countermeasures and remedial actions. Interview findings are given from government organizations, carrier and shipper associations, and insurance underwriters. An economic model of cargo loss is presented, involving direct, indirect, and intangible costs. A method of estimating losses is discussed, with data presented for trucking, railroad, airline, and maritime carriers, plus information from government experience. Some conclusions and recommendations are made, with an indication of possible automated systems of analysis.

Water Supplies and Hydrology

DETERGENTS IN WATER—A BIBLIOGRAPHY

U.S. Department of Interior, Office of Water Resources Research. December 1971. 460 pages.

PB–206 527

The large use of detergents in an area and the dumping of waste water containing them into surrounding lakes and streams can cause adverse environmental effects. Such effects include eutrophication, accelerated weed and algae growth, as well as ecological imbalances. The bibliography is a compilation of 282 abstracts involving detergents in fresh water systems. The topics include detergent sources, composition, ecological effects, nutrient content, and eutrophication effects. Author and subject indexes are included.

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REGULATION OF FLOOD HAZARD AREAS TO REDUCE FLOOD LOSSES. VOLUME ONE

U.S. Water Resources Council. Jon A. Kusler, and Douglas A. Yanggen. 1971. 600 pages.

PB–209 128

This report explores selected issues in the regulation of private and public land uses to reduce flood losses and, in particular, it presents draft statutes and local ordinances for regulation of land uses in riverine and coastal flood hazard areas. It focuses upon the use of regulations to guide adjustment of individual land uses in meeting flood threats and to avoid flood damages. In many cases these are economic and desirable adjustments. Where remedial protection of flood-prone lands through construction of dikes, dams, seawalls, and levees to reduce existing flood hazards is found feasible, regulations can often be employed to supplement the degree of protection afforded and to insure the integrity of the works. Volume One may be used independently of Volume Two, which is not yet available.

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DEVELOPMENT OF ECONOMIC WATER HARVEST SYSTEMS FOR INCREASING WATER SUPPLY

University of Arizona, Water Resources Research Center. C. B. Cluff, G. R. Dutt, P. R. Ogden, and J. L. Stroehlein. September 1971. 59 pages.

PB–209 865

Water supplies in arid and semi-arid lands have long been a problem. Due to population demands there is an increasing need to apply modern technology to developing countries. This almost always means an increased demand for water supplies. A water harvesting system is described in this report which provides a more efficient method of collection and storage of precipitation, than is available under natural conditions. Specifically, the use of gravel-covered plastic catchments has been proven to be a reliable method for the collection of sediment-free runoff and costs below other know methods. A practical device is described for separating naturally occurring gravel from soil and dispensing it over the plastic. In related work, the value of gravel mulch in reducing the water requirements of horticultural crops was demonstrated, and it was found that sodium chloride can be used to increase the runoff from bare soils.

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INTRODUCTION OF RISK AND UNCERTAINTY CONCEPTS TO OPTIMIZATION OF WATER RESOURCES SYSTEM DESIGN

Texas A and M University, Institute of Statistics. Rudolf J. Freund. December 1971. 110 pages.

PB–209 927

This report deals with the methodology for the inclusion of economic risk as a consideration in the planning of water resource systems, particularly with respect to the use of such systems for farm irrigation. The basic premise is that, since risk taking is an acceptable economic alternative, it may be worthwhile to design water resource systems which do not guarantee delivery, with certainty, of all necessary water at all times. The primary methodology used is simulation although some optimization techniques are also used. Ae series of related papers is appended, dealing with: Development of a model to evaluate hydrologic risk in a water resource system; evaluation of acceptable economic risk due to occasional failures to deliver water; comparison of stochastic linear programming and simulations for the evaluation of hydrologic/economic risks in water resource system design; the effect of risk taking by users of irrigation water; risk programming as an aid in the planning of a reservoir-irrigation system.

THE ROLE OF RESEARCH AND DEVELOPMENT IN WATER RESOURCES PLANNING AND MANAGEMENT FOR ACHIEVING URBAN GOALS

National Planning Association, Center for Techno-Economic Studies. Miller B. Spangler. October 1971. 650 pages.

PB–210 133

Except in traditionally water-short regions, urban centers have usually taken water supply for granted. Recently a change in attitude has resulted from factors such as population growth, increasing per capita consumption, shortages from drouth, falling water tables, pollution, and industrial demand. Projection of these factors show that responsible planning is vital, but the process is complicated, involving sometimes conflicting uses, quality and reliability of supply, and technology. The report does not assess relative importance of these factors, but is concerned with the planning process itself. It discusses the formulation of a use-goal matrix, and application of the matrix to two United States municipalities, one apprehensive as to its future water supply, the other concerned with protecting present resources. Social responsibility and planning mode are related; technological alternatives for urban use are explored; and the potential role of research and development is brought to attention.

URBAN WATER RESOURCES PLANNING AND MANAGEMENT

Texas A and M University, Texas Water Resources Institute. September 1971. 182 pages.

PB–210 325

This document contains the proceedings of the 16th Annual Conference on Water for Texas. The topics covered include: Perspectives in urban water management; systems description for urban water resources; conjunctive use of surface and ground water in urban water supplies; hydrometeorology for urban runoff systems; flood plain planning in urban areas; socio-economic aspects of urban water planning; cost comparison of conventional water use and reuse; river basin quality simulation.

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CHROMIUM IN WATER. A BIBLIOGRAPHY

U.S. Department of the Interior, Water Resources Scientific Information Center. June 1972. 131 pages.

PB–210 921

This bibliography contains abstracts of publications dealing with the occurrence and effects of chromium and chromium compounds in natural water bodies. Most of the publications referenced are available either in the open journal literature or from NTIS. Subject and author indexes are included.

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HYDROLOGY AND WATER RESOURCES DEVELOPMENT IN NEPAL

U.S. Geological Survey; and Nepalese Department of Hydrology and Meteorology. W. W. Evett. June 1969. 112 pages.

PB–212 035

Water has long been recognized as one of Nepal's most promising resources. Yet, prior to 1960 little had been done to investigate and appraise the resource. By 1969, a nationwide network of hydrological stations has been established, and a ground-water exploration effort has begun. Furthermore, the Department of Hydrology and Meteorology had been established, staffed, and equipped to conduct investigations. This report discusses the history of hydrological investigations in Nepal, and the relation of these investigations to the social and economic problems of water-resources development and management. The general hydrology of the more important river systems of the country is described in detail.

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DDT IN WATER. A BIBLIOGRAPHY

U.S. Department of the Interior. Water Resources Scientific Information Center. October 1971. 283 pages.

PB–212 262

This bibliography contains 196 abstracts of publications dealing with the occurrence and effects of the insecticide DDT in natural water bodies. Most of the referenced publications were published during the period 1967–1971. Also included are summaries of research projects in progress. A subject index is included.

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THE IMPORTANCE OF ECONOMIC FACTORS IN URBAN SURFACE WATER SUPPLY SYSTEMS

Water Resources Engineers, Incorporated. G. K. Young, G. F. Tierney, and J. S. Selekof. June 1972. 118 pages.

PB–212 275

This report concerns the importance of economic factors on decisions relating to the planning in an urban surface water supply system. Economic factors include: Rate of population growth, rate of industrial growth, water use rates, waste water reuse, recreation, costs of construction, operation and maintenance of facilities, interest rates, and costs of using alternative water supplies in the event of local water shortages. The study centers around the use of a simulation model to determine the economic response of an urban surface water supply system to changes in economic factors and hydrologic data.

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Agricultural
Development

ESTIMATED WORLD FERTILIZER PRODUCTION CAPACITY AS RELATED TO FUTURE NEEDS, 1970 TO 1975

Tennessee Valley Authority, National Fertilizer Development Center. E. A. Harre, F. M. Kennedy, T. P. Hignett, and D. L. McCune. June 1970. 32 pages.

PB–211 427

This report provides a supply-demand comparison of fertilizers on a worldwide basis. It reviews regional consumption, production, and production capacity, and it estimates future consumption along with planned plant capacity. In addition to fertilizer consumption, the estimates deal with the question of whether the developing countries in particular are gaining, losing or remaining at a stable level with respect to food production.

ENGINEERING EVALUATION OF SELECTED FERTILIZER PRODUCTION FACILITIES IN COLOMBIA

Tennessee Valley Authority, National Fertilizer Development Center. I. W. McCamy, and D. R. Waggoner. August 1970. 45 pages.

PB–211 428

This report is the result of a study by a team of experts of two segments of the Colombian fertilizer industry: (1) the facilities of Fertilizantes Colombianos, S.A. (FERTICOL), and (2) a sampling of small bulk-blending plants. The first part of the report provides general information about the fertilizer situation n Colombia. The results of the analysis of the FERTICOL plant are then presented. This includes flow diagrams of alternative production schemes, and projections of investment and operating costs. Similarly, operating problems are identified and alterations n equipment, raw materials, and procedures to improve operations are suggested for the bulk-blending plants.

TRAINING MANUAL FOR FERTILIZER PLANT OPERATORS

Tennessee Valley Authority, National Fertilizer Development Center. October 1970. 247 pages.

PB–211 628

The purpose of this manual is to assist in the training of fertilizer plant operators in the developing countries. It is an effort to share with the chemical industries in these countries experience that has been obtained over many years of operation at the National Fertilizer Development Center. Simple instructions, accompanied by abundant diagrams, are provided for all types of equipment to be found in most fertilizer plants. The topics covered include: Conveyors, elevators, crushers, screens, bins, tanks, dust collectors, weighing equipment, forklifts, front-end loaders, sampling, packaging, pumps, compressors, valves, pipeline flows, filtering equipment, absorption and spray tower, agitation, overhead cranes, common instrumentation, burners, centrifuges, heating and cooling equipment, granulating equipment, neutralization and reaction equipment, concentration equipment, refrigeration equipment, preventive maintenance, lubrication, and safety.

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TECHNICAL AND ECONOMIC EVALUATION OF FERTILIZER INTERMEDIATES FOR USE BY DEVELOPING COUNTRIES

Tennessee Valley Authority, National Fertilizer Development Center. G. C. Hicks, R. D. Young, J. J. Stumpe, M. M. Norton, and M. J. Richards. March 1970. 56 pages.

PB–211 629

In the past comparatively little emphasis has been placed on the position of fertilizer intermediates in supplying the fertilizer needs of the developing countries. Instead, the development of the basic industry has been promoted, using as many indigenous raw materials as possible. It now appears that imported fertilizer intermediates have a good potential to supply such countries with needed fertilizers more quickly and with less impact on foreign exchange than might be expected. In some cases, the import of intermediates can serve as a short-term requirement until a more basic fertilizer industry can be established. This document provides an economic analysis of the prospects for fertilizer intermediates in the developing countries. An effort is made to rationalize the economic and practical examples by hypothetical planning exercises for the case of a few typical countries (India, South Vietnam, Uruguay) with large and small needs for fertilizers. The intermediates of primary concern are anhydrous liquid ammonia, low or nonpressure nitrogen solutions, phosphoric acid, and elemental phosphorous.

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FERTILIZER DISTRIBUTION IN INDONESIA—1969

Tennessee Valley Authority, National Fertilizer Development Center. John R. Douglas, Jr., Paul J. Stangle, and James E. Hawes. February 1970. 62 pages.

PB–211 639

During recent years chemical fertilizers have been used with ever-increasing frequency in Indonesia. The effectiveness of this means of increasing crop production has been widely demonstrated in many field experiments, demonstrations, and farm practices with many crops, especially rice. This report provides the results of a study of fertilizer marketing and distribution with special reference to the operation of P. N. Pertani, a government organization which is a major distributor of fertilizers. Among the topics covered are: Organziation of P. N. Pertani headquarters unit and typical field units; fertilizer stocks and accounting procedures; procedures for determining fertilizer demand; credit availability; inventory management procedures; and relationship of P. N. Pertani to private enterprise. A series of recommendations is provided.

A FERTILIZER PROGRAM FOR BOLIVIA

Tennessee Valley Authority, National Fertilizer Development Center. Darrell A. Russel, Ralph J. Ballew, John I. Bucy, and Donald A. Waitzman. June 1970. 114 pages.

PB–211 761

Bolivia annually imports over $23 million of agricultural products, including wheat, edible oils, fibers, and dairy products. Wheat is by far the most costly of these imports, and it also seems the most amenable to increased domestic production through the use of new varieties and fertilizers. With lower costs, fertilizer could also be profitably used on such crops as corn, quinoa, rice, cotton, and sugarcane. This document provides a review of the fertilizer program in Bolivia, evaluates its need for fertilizer plants, and analyzes the possibilities for fertilizer marketing. Some of the areas covered include: The state of Bolivian agriculture and the physical factors that affect it; Government of Bolivia agricultural programs; Bolivian resources, facilities, and policies relative to fertilizer production, marketing, and use; potential for fertilizer use by crop, area, and type of fertilizer; meeting the fertilizer requirements by domestic production and by importation; alternative long-range fertilizer programs.

RECOMMENDATIONS FOR FECOAGROH GRAIN STORAGE FACILITIES IN HONDURAS

Kansas State University, Food and Feed Grain Institute. Elwin S. Holmes. July 1971. 43 pages.

PB–211 843

This report provides details concerning the development, design, and evaluation of grain receiving, storage, and handling facilities for the National Federation of Agricultural Cooperatives (FECOAGROH) in Honduras. Detailed descriptions and plan views are given of recommended facilities. An appendix lists U.S. manufacturers and suppliers of equipment referred to the report. The document may be of interest to those planning grain storage and handling facilities elsewhere.

A REVIEW OF CERTAIN ASPECTS OF THE FORESTRY PROGRAM AND ORGANIZATION IN INDONESIA

U.S. Department of Agriculture, Foreign Economic Development Service; and Agency for International Development. Burnett H. Payne, and David S. Norwall. April 1971. 62 pages.

PB–211 882

Indonesia's forest resources represent one of her most valued assets. These resources are not inexhaustible, however, and it is essential to protect them from destructive exploitation. This report provides a review of timber operations in Indonesia, identifies problem areas, and offers a series of recommended solutions. Emphasis is placed on the organization of the Directorate General of Forestry; the use of forest lands, particularly with respect to the granting of timber concessions; the forestry research program; and environmental considerations.

OBSERVATIONS AND RECOMMENDATIONS FOR IMPROVING GRAIN STORAGE AND MARKETING IN BOLIVIA

Kansas State University, Food and Feed Grain Institute. Floyd F. Niernberger, and Harry B. Pfost. May 1971. 96 pages.

PB–211 883

This report provides an evaluation of storage and related marketing requirements for the development of the wheat, rice, corn, and soybean industries in Bolivia. Both observations on present conditions and recommendations for future development are given. A 27-page appendix presents detailed guidelines for determining the capacity of various components of a grain storage facility, which should prove generally useful to those interested in this field.

PLANT PROTECTION PROBLEMS IN SOUTHEAST ASIA

Cornell University; University of California, Riverside; and U.S. Department of Agriculture, Agricultural Research Service. Edward H. Glass, Roy J. Smith, Jr., Ivan J. Thomason, and H. David Thurston. 1971. 74 pages.

PB–212 101

Improved crop protection can do little to reduce the population explosion in East Asia, but it can make important contributions toward assuring an adequate food supply until populations become stabilized through family planning and birth control. This document is the report of a study team which had as its objective the appraisal of the nature and the scope of pest problems affecting food production in the Philippines, Thailand, Malaysia, Taiwan, Hong Kong, Singapore, and Japan. An effort was also made to determine whether the local environment and public health are endangered by improper use and lack of management of pesticides on food and other major crops. Specifically, consideration is given to the status and needs of crop protection in tropical East Asia; economic and environmental implications of crop protection; possible approaches to solutions of crop protection problems; some international and foreign agencies in plant protection activities in tropical East Asia; and pesticides in public health activities.

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A GENERALIZED SIMULATION APPROACH TO AGRICULTURAL SECTOR ANALYSIS, WITH SPECIAL REFERENCE TO NIGERIA

Michigan State University. November 1971. 378 pages.

PB–212 187

Because of the difficulties and uncertainties involved in solving economic development problems, researchers have turned to sys- em simulation as a possible means of providing decision makers vith information about the likely consequences of alternative esource allocations. A simulation study provides a group of time istories, each representing the outputs of a particular set of as- umptions, exogenous variables, and policies. This report describes fforts to develop a general simulation approach to studying agri- ultural development. In order to develop such a simulation, it is ecessary to model something in the real world. The Nigerian gricultural economy was chosen for this purpose since, for its odeling, it requires the construction of components which have idespread usefulness among both developed and developing ountries. Consideration is given to the socioeconomic-environ- ental setting which the model is intended to simulate, the pro- edures of model estimation, refinement, testing, and validation. he major components of the Nigeria model are described, and e model is used in several policy experiments to provide both ractical results and illustrations of the variety of uses to which e simulation model can be addressed. The requirements for ractical implementation of this kind of model in developing ountries are discussed.

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A LITERATURE SURVEY ON THE SUBJECT OF THE USE OF ACOUSTICS IN FISH CATCHING AND FISH STUDY

Catholic University of America, Institute of Ocean Science and Engineering. Bhupinder Singh Dang, and F. A. Andrews. May 1971. 105 pages.

AD–743 102

The present contribution of fish to the world's food supply is 1% and to the animal protein supply is 10%. It has been estimated that, with improved fishing techniques and fisheries management, this contribution can be increased 3 to 5 times. One technique that has become increasingly useful in the past three decades has been the use of acoustic fish-locating methods. The same methods have also been of great value in the study of food fishes in their natural surroundings. This document traces the history of the use of acoustics in fish catching and fish study, and briefly describes the present state-of-the-art. It provides a comprehensive bibliography of the relevant papers and books, and gives summaries of certain significant papers.

DEVELOPMENT OF THE CAGE CULTURE METHOD OF FISH PRODUCTION FOR COMMERCIAL USE IN LARGE RESERVOIR LAKES

State Colleges of Arkansas. Richard A. Collins. August 1971. 14 pages.

COM–72–10056

Reservoir lakes are particularly well suited for culturing fish in cages. Since the depth of water in reservoirs is much less limiting than in ponds, the size of a cage can be appreciably larger and thereby more efficient. This report discusses the results of an investigation of the influence of a number of variables on the growth and mortality of fish cultured in such cages. Included are the effects of cage depth, surface area, and relative sizes of fingerlings introduced into the cages. The importance of wild fish in the vicinity of the cages is discussed, and a method for dealing with them is described.

PROPOSED FISHERY PROGRAM FOR ECUADOR

Auburn University, International Center for Aquaculture. H. S. Swingle. May 1971. 44 pages.

PB–211 642

This report is a result of a survey which was undertaken to determine how the U.N. Food and Agriculture Organization and the U.S. Agency for International Development could best coordinate their fisheries programs to provide joint assistance of most benefit to Ecuador. Some of the topics discussed are: Reorganization of the Departamento de Pisciculture; soils, water, and fish in the

Oriente; the coastal area near Esmeraldas; and introduced species of fishes in Ecuador. In addition, an outline is provided for a proposed coordinated fisheries program.

FISHCULTURE SURVEY REPORT FOR COSTA RICA

Auburn University, International Center for Aquaculture. R. T. Lovell, and D. D. Moss. May 1970. 42 pages.

PB–211 643

The report presents observations and recommendations which are made as a result of a survey of the inland fisheries of Costa Rica. The survey was undertaken for the purpose of providing technical advice on freshwater fisheries research programs in the country and on developing programs for the production of fish for food by farmers or commercial investors. The topics covered in the report include: General conditions in Costa Rica which may affect fishculture considerations; government divisions responsible for fisheries development; fishculture research and training; and available sources of capital, land and feedstuffs.

INLAND FISHERIES PROGRESS IN THAILAND, 1971

Auburn University, International Center for Aquaculture. H. S. Swingle, and E. W. Shell. January 1972. 117 pages.

PB–211 663

This document provides a review and evaluation of the status of and the progress made by the Thailand inland fisheries program during 1971. Some of the topics covered are: Highlights of 1971 research results (village reservoir management, efficiency of various fish species, combined rice and fish culture, cage and pen culture of fish, freshwater shrimp culture); parasites affecting fish and man; problems arising in culture and marketing of Trichogaster pectoralis and Clarias batrachus; hatchery production and fish distribution; Department of Fisheries organization; titles of current and recently completed fisheries research projects; synopsis of physical and biological data for the fisheries units and the fisheries research stations; fisheries statistics.

AQUACULTURAL DEVELOPMENTS IN PERU

Auburn University, International Center for Aquaculture. D. D. Moss. April 1972. 57 pages.

PB–211 671

As part of an overall effort to reduce the outlay of foreign exchange for the importation of beef, the Government of Peru is striving to develop to the fullest extent the country's fisheries resources. An important part of this effort involves aquaculture. This report reviews the present status of aquaculture in Peru and provides a series of recommendations for future development. Some of the topics covered include the potential for coldwater and warmwater fishculture; a proposed project for culturing fish in pens; a proposed warmwater aquacultural research station; organizational structure of the Ministry of Fisheries; existing fisheries stations and equipment; and fisheries personnel and their training.

THE FEASIBILITY OF HARVESTING, PROCESSING, AND MARKETING TUNA IN PAKISTAN

Agency for International Development, Mission to Pakistan; an Government of Pakistan, Department of Fisheries. A. M. Morgan S. A. Jalil, M. A. Burney, D. M. Jones, and J. G. Unti. 1970 99 pages.

PB–211 762

The geographical locale of Karachi, with access to known productive tuna fishing areas along with a coastal population of traditional fishermen, are favorable considerations in the development of a deep sea tuna fishing industry for Pakistan. There is a increasing world demand for both frozen and canned tuna, especially in the highly industrialized nations of the world. This marke offers the opportunity for Pakistan to earn foreign exchange fo such other goods that are required for industrial expansion an economic development. This report is primarily concerned wit two aspects of tuna fishery development: a fishery fleet, and fish cannery. Its purpose is to acquaint interested persons wit the potential success of a tuna fishing industry and to encourag further consideration of the value of such an investment. A analysis of economic benefits and implementation alternatives i included.

FISHERIES OF TURKEY

Auburn University, International Center for Aquaculture. H. S Swingle. January 1972. 28 pages.

PB–211 774

This document briefly reviews the status of the Turkish fisherie program, and provides some recommendations for possible development. The topics covered include: Food and population water areas and fisheries; government divisions and universitie dealing with fisheries; possibility of fisheries in the poppy-growin areas. Also included are a list of equipment and chemicals neede for a basic water chemistry laboratory; a list of equipment neede for a basic limnological research laboratory; and a brief list o references of possible use in identifying fishes of Turkey.

STATUS OF TROUT CULTURE IN PERU

Auburn University, International Center for Aquaculture. E. W Shell. August 1971. 54 pages.

PB–211 775

Fisheries and Aquaculture (continued)

This document reports the results, and provides recommendations based on those results, of a survey of trout hatcheries and trout farms in Peru. The purpose is to evaluate the potential for trout farming in Peru and to evaluate certain aspects of the Ministry of Fisheries' proposed program for the development of the trout farming industry.

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FISHERIES

Agency for International Development, Office of Agriculture and Fisheries. June 1971. 62 pages.

PB–212 238

This document is comprised of abstracts of 165 publications which deal with fisheries programs, projects, and research in newly developing countries. The topics covered include fish culture, fish protein concentrates, fishery products processing and marketing, and training of fisheries personnel. The abstracts are arranged according to geographic region, where possible.

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Food Technology

FISH PROTEIN CONCENTRATE: A COMPREHENSIVE BIBLIOGRAPHY

Library of Congress, Science and Technology Division; and Bureau of Commercial Fisheries, National Center for Fish Protein Concentrate. April 1970. 83 pages.

PB–191 100

This bibliography was prepared to provide a source of information
n efforts directed toward fish protein concentrate for human
onsumption. An effort was made to include all of the literature
n the subject published from 1940 through 1969. Each of the
08 entries is accompanied by an abstract, and is arranged into
ne of five major categories: General aspects, processing methods,
hemical composition, nutrition studies, and acceptability and use
n foods. Author and subject indexes are included.

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OOD MARKETING IN DEVELOPING COUNTRIES

.S. Department of Agriculture, Foreign Economic Development
ervice; and Agency for International Development, A.I.D. Ref-
rence Center. Robert W. Taylor. December 1971. 56 pages.

B–211 641

his document brings together a summary of studies on the do-
estic marketing of food in the less developed countries which
ave been done by or for the Agency for International Develop-
ent. It is essentially a bibliography with an abstract provided for
ch bibliographic entry. The entries are arranged by general sub-
ct, by geographic region, and by commodity. A personal/corpo-
te author index is included.

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THE MARKETING CHALLENGE. DISTRIBUTING INCREASED PRODUCTION IN DEVELOPING NATIONS. PROCEEDINGS OF A CONFERENCE IN WASHINGTON, D. C. JUNE 18-19, 1970

U.S. Department of Agriculture, Foreign Economic Development Service; and Agency for International Development, Bureau of Technical Assistance. Martin Kriesberg (Editor). December 1970. 104 pages.

PB–211 658

Inadequate transportation and storage, poor market information, lack of capital, and other chronic marketing problems in developing countries have been dramatized by recent production increases. This document is based on a symposium which was organized to focus attention and resources on food marketing in developing nations. Topics covered include: Key considerations in marketing policies; marketing enterprises and the flow of resources into marketing functions; nutrition and marketing food for the needy; efficiency in the marketing system; regional experiences in marketing problems and priorities; and approaches to technical assistance.

MARKETING OF STAPLE FOOD CROPS IN TROPICAL AFRICA: OVERALL ANALYSIS AND REPORT

Stanford Research Institute. William O. Jones. June 1969. 280 pages.

PB–211 669

The body of knowledge concerning the food-marketing systems of that portion of Africa lying between the Sahara and the Republic of South Africa has been quite meager. Because of this lack, doctrinaire assessments—many of them quite insupportable—have been made at both academic and policy-making levels. This report is an end product of a study undertaken to identify practical methods for increasing the efficiency with which staple foodstuffs are marketed in tropical Africa. It describes the structure of selected food marketing systems in tropical Africa in terms of product flow, exchange levels, personnel, and marketing; it appraises the performance of the systems; and it identified measures that might be adopted to improve its efficiency. The specific subjects of the report are the trade in staple foodstuffs in the supply hinterlands of four major cities: Nairobi, Kenya; Enugu, Nigeria; Ibadan, Nigeria; and Freetown, Sierra Leone. In each of these areas attention is directed at the trade in particular food commodities that are major contributors of food calories to local diets, and at certain other staples of major importance in the food trade.

CORN FORTIFICATION: A FIELD DEMONSTRATION MODEL

Institute of Nutrition of Central America and Panama (Guatemala); and Rutgers University—The State University of New Jersey, Department of Food Science. Leonardo J. Mata, Ricardo Bressani, Paul A. Lachance, and Miguel A. Guzman. June 1971. 45 pages.

PB–211 672

Protein deficiency is a major problem in Central America, as it is in most societies through the world that occupy similar ecosystems. An apparent measure to correct this deficiency in utilizable protein would be to increase the production and consumption of animal protein, but the approach has very serious economic and socio-cultural limitations. A nutrition improvement approach that appears to be feasible is the fortification of a food that is normally part of the regular diet to a level sufficient to correct the protein deficiency. In the Central American countries corn, which is consumed primarily in the form of tortilla, would seem to lend itself well to this technique. This document outlines a proposed field methodology to determine the feasibility of the corn fortification approach at the community level. It discusses he rational of the corn fortification method, the necessary nutriional-epidemiological studies, the possible significance of the proposed research, and reasonable expectations in terms of national development. The document is written specifically in the context of the situation in Guatemala, but it may be useful to those mplementing similar studies elsewhere.

COMMERCIAL FEASIBILITY OF FISH PROTEIN CONCENTRATE IN DEVELOPING COUNTRIES. VOLUME II, PART I—CHILE, INVESTMENT ASPECTS AND GENERAL SUMMARY

General Oceanology, Incorporated; American Technical Assistance Corporation; and Sidney M. Cantor Associates, Incorporated. Gerald D. Bernstein. June 1970. 78 pages.

PB–212 001

The report analyzes the feasibility of commercial production of sh protein concentrate (FPC) in Chile. This first part of Volume I consists essentially of summaries and condensations of the gnificant portions of the study, with enough detail to enable to stand as an independant document. The topics include: The Chilean food system and the potential market for FPC; the isoropyl alcohol process and possible competitors; cost of FPC prouction; company organization and financing structure for an PC enterprise in Chile; alternative protein sources. (Volume I f this report pertains to a similar study done for Korea. See MTID, June 1972, page 91).

COMMERCIAL FEASIBILITY OF FISH PROTEIN CONCENTRATE IN DEVELOPING COUNTRIES. VOLUME II, PART II–CHILE, BACKGROUND INFORMATION AND SUPPORTING DATA

General Oceanology, Incorporated, American Technical Assistance Corporation, and Sidney M. Cantor Associates, Incorporated. Gerald D. Bernstein. July 1970. 384 pages.

PB–212 002

The report analyzes the feasibility of commercial production of fish protein concentrate (FPC) in Chile. This second part of Volume II provides detailed information from which the discussions and conclusions of Part I were drawn. The subjects covered include: The Chilean food situation and market for FPC; proposed specifications and quality characteristics for FPC; selection of process and plant capacity; plant design and construction; process description; raw fish supply; cost of production and investment for a fish protein concentrate plant; modified FAO provisional pattern for protein; relationships among income, food distribution, and per capita calorie and protein intakes in Chile; survey of nutrition and health patterns in Chile; acceptability of fortified foods in the province of Curico.

COST BENEFIT ANALYSIS OF SELECTED RADIATION PASTEURIZED FOODS

U.S. Department of Agriculture, Economic Research Service Bureau of Commercial Fisheries; and Dunlap Associates, Agr Division. Kermit Bird (Editor). September 1972. 276 pages.

TID–25557

Irradiation-pasteurization has been discussed as a food-preservin method for several decades, and research has been applied t questions of dosage levels, dosimetry, side effects, storage condi tions, packing, packages, and wholesomeness aspects. This repor examines potential cost-benefits of using irradiation-pasteurizatio to reduce spoilage losses and extend the shelf life of certain food that, according to the results of irradiation testing, held promis of benefiting from the process. Sixty one foods were initially se lected for analysis; separate chapters of the report provide detaile discussions of twenty one of the most interesting of these.

Food Technology
(continued)

BIBLIOGRAPHY ON THE CENTRALIZED PROCESSING OF FRESH MEAT AND POULTRY INCLUDING RADIATION PASTEURIZATION (UPDATED)

Michigan State University, Department of Food Science and Human Nutrition. W. M. Urbain, P. S. Belo, G. G. Giddings, and S. Wang. March 1972. 74 pages.

TID–25998

This biliography is comprised of approximately 475 references to iterature sources concerning the centralized processing of meat and poultry, including those involving radiation pasteurization. The entries are arranged according to the following categories: Radiation pasteurization of fresh meat and poultry and related adiation references; retailing and wholesaling of fresh meat and oultry, including centralized cutting; pigment and color of fresh neat and poultry; fluid exudation and water holding capacity of resh meat and poultry; general microbiology of fresh meat and oultry; relevant patents. Author and subject indexes are included.

Industrial and General Economic Development

ECONOMIC RESOURCES OF THE UNION OF BURMA

U.S. Army Natick Laboratories, Earth Sciences Laboratory. Nafis Ahmad. May 1971. 337 pages.

AD–748 834

This document presents an in-depth study of the economic geog- aphy of Burma. Included are sections on human resources, physi- al setting, climate, vegetation, soils, agriculture, mineral resources, ndustries and industrial development, power and energy, transpor- ation, and trade and commerce. A final section analyzes and valuates economic development in Burma. A bibliography of 572 items, arranged by general subject, is included.

GROWTH AND LABOR CHARACTERISTICS OF MANUFACTURING INDUSTRIES

Economic Associates, Incorporated. March 1972. 105 pages.

COM–72–50355

This document is designed as a technical tool and research aid for hose working in the industrial development field. Specifically, the tudy lists manufacturing industries ranked by growth trend and rovides supporting information on labor characteristics. Its pur- ose is to provide a starting point for those wishing to locate and ttract new industry to a development area. While the document esponds to a variety of questions, the following are representative f the types of answers it can provide: Which industries show rowth potential and, therefore, present industrial development opportunities; how does a particular industry rank in its investment in plant and equipment; which industries are likely to place greatest emphasis on low skilled labor, or on an abundance of production type workers; what is the size of a given industry as represented by value of shipments. The information provided is oriented primarily to the U.S. situation, but it may be of value elsewhere, particularly where there is a desire to attract or otherwise interact with U. S. industry.

COMMON EXTERNAL TARIFF FOR THE ANDEAN GROUP

Harvard University, Center for International Affairs. David Morawetz. February 1972. 58 pages.

PB–211 488

The Cartagena Agreement signed by members of the Andean Group (Bolivia, Chile, Colombia, Ecuador, and Peru) calls for member countries to agree by December 1975 on a common external tariff which they are to implement gradually from 1977 to 1980. This paper first discusses some historical and theoretical considerations underlying the design of a common external tariff structure, and then sets out two proposals for the common external tariff of the Andean Group. The proposed tariff structures are compared with prior Andean National Tariff systems and the Andean Common Minimum External Tariff, and some implications are discussed for policy on export subsidies, exchange rates, and non-tariff restrictions.

INTRODUCTION TO RECORD KEEPING IN A SMALL ENTERPRISE

Agency for International Development; and Industrial Development Center (Zaria, Nigeria). R. F. Bruckart. May 1968. 154 pages.

PB–212 034

Much experience is now available on the fundamental methods employed by those managers of small businesses in industrially developing countries who have developed profitable operations. Effective record-keeping, it has been found, is one of these methods. This document introduces basic record-keeping methods similar to those that managers of small industries throughout the world have found useful. The topics covered include: Recording daily transactions; planning and controlling production; records of material or supplies; quality control records; employee records; and how the manager uses records. The document was prepared for use by small-enterprisers in Northern Nigeria, but it should be generally applicable elsewhere.

TECHNOLOGY TRANSFER—A SELECTED BIBLIOGRAPHY (Revised Edition)

University of Denver, Denver Research Institute. Terry Sovel Heller, John S. Gilmore, and Theodore D. Browne. February 1971. 181 pages.

N71–20921

This bibliography provides a comprehensive listing of literature on technology transfer. In addition, an identification is made of key literature in the field. Over 560 references are included; abstracts are given for those considered to represent the key technology transfer works. Author and subject indexes are also included.

* * *

GENERATING SOCIAL IMPACT SCENARIOS, A KEY STEP IN MAKING TECHNOLOGY ASSESSMENT STUDIES

The Mitre Corporation; and George Washington University, Program of Policy Studies in Science and Technology. Martin V. Jones. April 1972. 25 pages.

N72–24978

Technology assessment is a form of planning research that seeks to anticipate the impacts that might arise from the application of a new technology. The scenario, or systems operation script or plot, has been used in a number of fields to trace in structured fashion the expected interactions. The report is concerned with construction of a social impact scenario as discussed in a 1972 seminar held in Washington, D.C. on technology assessment methodology. Some illustrative scenarios are presented, along with flow diagrams, historical review methods, and the use of scientific conjecture. Four types of information are associated with an event: How probable is it that an interaction will occur? Will an earlier event cause a later one to interact in increasing or decreasing direction? What would be the magnitude of a possible interaction? How long after an earlier event would a later one occur? Multiple consequences flowing from one event to an ensuing one are outlined. Some specific examples are given. An important feature in the discussion is the matter of data collection for valid forecasting.

* * *

SUCCESSFUL INDUSTRIAL INNOVATIONS

National Science Foundation. Sumner Myers, and Donald G. Marquis. 1969. 124 pages.

PB–211 097

Innovations are units of technological change. Every nation, industry, and firm is concerned with the introduction of new or improved products and processes. Innovation is acknowledged to contribute to economic growth and social benefits, but it is essential for survival in the competitive world. This document summarizes a study which was undertaken to provide empirical knowledge about the factors which stimulate or advance the application in the civilian economy of scientific and technological findings. Several industries (railroads and railroad suppliers, computer manufacturers and suppliers, and housing suppliers) were selected to provide a view of the innovation process in industries with differential involvement in, and dependence on, current technological advances. The results are presented in a manner intended to highlight the differences, or similarities, of the innovative process in the selected industries.

TECHNOLOGY AND ECONOMICS IN INTERNATIONAL DEVELOPMENT. REPORT OF A SEMINAR, MAY 23, 1972

Agency for International Development, Office of Science and Technology. May 1972. 89 pages.

PB–211 192

This document contains the papers and summaries of comments presented at a seminar which was designed to help clarify the impact of the macro-economic framework in the developing countries on the choice of technologies introduced into these countries. Some of the topics covered include: Economic framework for optimum utilization of technology in the less developed countries; use of labor intensive techniques in Kenyan industry; evolution of a methodology for assessing the impact of technology in developing countries; engineering, commercial, and social considerations involved in the design of a basic motor vehicle for production and use in Southeast Asia.

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April 1973

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INTRODUCTION

Application of Modern Technologies to International Development is a new publication series sponsored jointly by the Agency for International Development and the National Technical Information Service (NTIS), United States Department of Commerce. The purpose of the series is to increase the ready availability of U.S. technical publications of special interest in developing countries to scientists, engineers, and planners in industrial and technological research institutions, universities, and government agencies to foster the transfer of technology to these countries.

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As a matter of convenience, the report descriptions are arranged according to general subject area. These subject classifications are somewhat arbitrary; furthermore, each entry appears only once in the publication, even though it might logically have been placed in more than one classification. The user is thus invited to scan the entire publication for items of possible interest.

Prices of the reports, listed by order number, appear on page 117.

ABOUT NTIS

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CHEMISTRY

Benefication and Refining

DEOXIDATION OF STEEL USING WASTE ALUMINIZING DROSS: A FEASIBILITY STUDY

Bureau of Mines, College Park Metallurgy Research Center. H. V. Makar, and P. J. Gallagher. July 1972. 12 pages.

PB–211 349

Aluminizing dross is a waste produced during an aluminum-coating process for steel products. The feasibility of using this waste product as a steel deoxidizer has now been demonstrated. Tests with melts ranging from 7 to 100 pounds showed that the dross is effective in reducing oxygen levels in steel. A direct comparison with aluminum wire revealed that the dross is at least as effective as the pure metal.

——o——

EXTRACTION PROCESS FOR UPGRADING Sm_2O_3 USING SELECTIVE STRIPPING TECHNIQUES

Bureau of Mines, Reno Metallurgy Research Center. D. J. Bauer, L. E. Schultze, and R. E. Lindstrom. 1972. 13 pages.

PB–211 948

The growth in demand for certain lanthanides has resulted in the development of industrial processes for their separation and purification from source materials. These operations have resulted in the availability of substantial quantities of a byproduct mixture of rare-earth elements that contain mostly samarium and neodymium, and lesser amounts of praseodymium, cerium, and lanthanum. Potential uses for samarium-cobalt alloys have generated an interest in developing methods for recovering samarium from these source materials. A system to obtain high recovery of greater than 99-pct-sure samarium (as Sm_2O_3) without gel formation in the organic phase has now been demonstrated. The method employs selective stripping techniques using di(2-ethylhexyl) phosphoric acid. This report describes the method in detail.

——o——

Chemical Analysis

HYDROCARBON TYPE ANALYSIS OF GASOLINE BY GAS CHROMATOGRAPHY

Army Fuels and Lubricants Research Laboratory. L. L. Stavinoha, and F. M. Newman. July 1972. 18 pages.

AD–748 446

Determination of the three major hydrocarbon types (saturates, olefins, and aromatics) is usually required for describing gasoline quality. A gas chromatographic method for making this determination is described in this report which, since it does not require sample preparation, is faster and more precise than current standard procedures. The apparatus, column preparation, and chromatographic procedure are given in detail. Examples of actual application of the techniques are also provided.

HIGH SPEED LIQUID CHROMATOGRAPHIC DETERMINATION OF TOTAL AROMATICS IN ENAMEL AND LACQUER SOLVENTS

Aberdeen Research and Development Center, Coating and Chemical Laboratory. George G. Esposito. July 1972. 17 pages.

AD–748 804

Aromatic solvents possess the strongest solvency of the hydrocarbon types; but because of their photochemical reactivity, use of these solvents in commercial products may be regulated by air pollution control laws. Paints are one class of such products. The report presents a new procedure based upon high efficiency liquid chromatography which is used to determine total aromatics in enamels and lacquer thinners. In the chromatographic column, the separation is obtained across a small bore column containing silica beads of controlled porosity without modifier. The method is rapid, accurate and applicable to a broad range of solvent blends.

CHARACTERIZATION OF ELASTOMERIC MATERIALS USED IN AUTOMOTIVE BRAKE AND COOLING SYSTEMS BY PYROLYTIC GAS CHROMATOGRAPHY

Aberdeen Research and Development Center, Coating and Chemical Laboratory. George G. Esposito and Robert G. Jamison. July 1972. 17 pages.

AD-748 805

Many elastomeric compounds are used for numerous automotive applications; the type of rubber needed for a specific function is determined by the service conditions and environment to which the rubber is exposed. Rigid quality control testing of rubber compounds is required to ensure the proper utilization of rubber components in civilian and military vehicles, such as automobiles, trucks, tractors, etc.; hence, a method of analysis for the characterization of rubber stocks and parts should be extremely valuable for quality assurance testing. This report describes an analytical procedure for the characterization of elastomers used for automotive applications with special emphasis on brake and cooling system components. The procedure involves the thermal degradation of an elastomer sample and subsequent gas-chromatographic analysis of the decomposition products. Positive identification is made by comparing the "pyrogram" from a sample with those obtained from reference materials.

DETERMINATION OF PETROLEUM CONTAMINATION IN BRAKE FLUIDS

Aberdeen Research and Development Center, Coating and Chemical Laboratory. Charles B. Jordan, and Robert G. Jamison. July 1972. 18 pages.

AD–748 806

Most conventional brake fluids are composed of glycols, polyglycols and glycol ethers with appropriate corrosion inhibitor additives. These fluids are compatible with styrene-butadiene (SBR) elastomers used in the brake systems of most automotive vehicles. If a conventional fluid is contaminated with petroleum base materials such as gasoline, kerosene, hydraulic fluid, automatic transmission fluid, motor oil or with a petroleum type brake fluid, the SBR elastomers swell excessively and disintegrate. Small quantities (less than 1%) of these contaminants will often cause catastrophic brake failure. A procedure has now been developed for the determination of small amounts of petroleum contaminants in conventional brake fluids. Gas liquid chromatography (GLC) and thin layer chromatography (TLC) are utilized.

—o—

ACTIVATION ANALYSIS: A BIBLIOGRAPHY THROUGH 1971

National Bureau of Standards, Institute for Materials Research. G. J. Lutz, R. J. Boreni, R. S. Maddock, and J. Wing. August 1972. 885 pages.

COM–72–50871

This bibliography contains well over 6,000 references to the world's literature describing work using activation analysis. Complete bibliographic data are provided for each entry. In addition, separate indexes are included for the element determined, the matrix analyzed, the technique used, and authors.

—o—

BUREAU OF MINES PROCEDURE FOR EVALUATING QUARTZ CONTENT OF RESPIRABLE COAL MINE DUST

Bureau of Mines. Samuel A. Goldberg, and Murray Jacobson. 1972. 14 pages.

PB–210 608

Quartz has a marked effect on lung tissue. The damage done by the chronic inhalation of quartz dust is permanent; an unalterable tissue change takes place in the lungs. Of prime importance is the fact that prolonged exposure to quartz results in a greatly increased susceptibility to tuberculosis. This report describes a laboratory procedure for determining the percent quartz in respirable coal mine dust samples. The method, based on infrared analysis, is faster than wet chemical methods.

—o—

DEVELOPMENT OF ANALYTICAL PROCEDURES FOR DETERMINING CHLORINATED HYDROCARBON RESIDUES IN WATER AND SEDIMENTS FROM STORAGE RESERVOIRS

Bureau of Reclamation, Engineering Research Center. Edward T. Lyons, and Howard A. Salman. April 1972. 13 pages.

PB–210 839

It is known that pesticides such as the chlorinated-hydrocarbon insecticides may endanger aquatic life, because of their slow degradation rates and toxicity. These compounds are carried into reservoirs principally in runoff water from treated agricultural lands, in the effluents from municipal sewage treatment plants, and in the waste products of industrial and manufacturing activities. This report describes analytical methods which were developed to detect and measure chlorinated hydrocarbon insecticides in reservoir water and bottom muds. Water may be routinely analyzed using a semiautomatic extraction with hexane, followed by gas chromatography. Sediments are also analyzed by gas chromatography, after a 16-hour soxhlet extraction.

* * *

METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTES

Environmental Protection Agency, Water Quality Office. 1971. 298 pages.

PB–211 968

This manual provides detailed procedures for the chemical analysis of fresh and saline water and wastewater samples. Usually both manual and instrumental methods are given where available. The factors which can be analyzed according to the procedures include: Acidity; alkalinity; arsenic; biochemical oxygen demand; chemical oxygen demand; chloride; chlorine requirement; color; cyanide; dissolved oxygen; fluoride; hardness; metals (including mercury); methylene blue active substances; nitrogen and its compounds; nitrilotriacetic acid; oil and grease; organic carbon; phenolics; phosphorus and its compounds; selenium; silica; solids; specific conductance; sulfate; sulfide; temperature; threshold odor; turbidity.

* * *

SULFUR COMPOUNDS IN CRUDE OIL

Bureau of Mines, Bartlesville Energy Research Center. H. T. Rall, C. J. Thompson, H. J. Coleman, and R. L. Hopkins. September 1972. 195 pages.

PB–212 504

The wide occurrence of sulfur and sulfur compounds in petroleum is a major problem. All facets of petroleum production, transportation, storage, processing, and use are adversely affected in varying degrees by the sulfur indigenous to it. This report describes

Chemical Analysis
(continued)

the special separation and identification techniques developed during a twenty-year study of the organic sulfur compounds of crude oils. It is written for both the student and the petroleum chemist. A discussion is provided of sulfur in many natural products, and the early literature covering petroleum sulfur identification is reviewed. Information is given in some qualitative and quantitative trends, on the most prevalent structures, and on similarities and differences in the sulfur content of various crudes. A bibliography of 472 references is included.

A THREE-MINUTE GAS CHROMATOGRAPHIC ANALYSIS OF THE MAIN CONSTITUENTS OF MINE ATMOSPHERES

Bureau of Mines, Pittsburgh Mining and Safety Research Center. Helen W. Lang, and Robert W. Freedman. October 1972. 12 pages.

PB–213 968

A gas chromatographic system is described which has proved efficient, rapid, and accurate for routine analysis of mine atmospheres. The system may be used for the routine determination of oxygen, nitrogen, methane, and carbon dioxide. It may be adapted to other types of samples with minor modifications.

Desalination

TITLE-AUTHOR-COMPANY INDEX TO REPORTS PUBLISHED BY THE U. S. DEPARTMENT OF THE INTERIOR OFFICE OF SALINE WATER, THROUGH JULY 1972

Oak Ridge National Laboratory, Nuclear Desalination Information Center. K. O. Johnsson. October 1972. 107 pages.

ORNL–NDIC–11–REV–1

A major portion of the water desalination research in the United States is done under the sponsorship of the Office of Saline Water. As of July 1972, over 800 reports had been generated as a result of the research. This document presents a word-by-word alphabetical index of these reports, prepared with the aid of a computer from their titles, authors, and report numbers. The reports have either been published in technical journals, or are available for sale by the U.S. Government Printing Office and NTIS. This document supersedes ORNL-NDIC-11, which was described in AMTID, October 1972, page 5.

PROPERTIES OF THE RARE EARTH METALS AND COMPOUNDS

Battelle Memorial Institute. John A. Gibson, and Gifford S. Harvey. January 1966. 352 pages.

AD–479 391

This document is comprised of the best available data on the properties of yttrium, the 15 lanthanide metals, and their compounds. The first section contains the tabulated physical and chemical properties of the elements and compounds, plus graphic representations of corrosion data. This is followed by a section containing over 200 phase diagrams. Finally, a detailed compilation is provided of the properties of the elements and their compounds, with reference to the source of information. A bibliography of about 290 entries is included.

VANADIUM SILICIDE

Hughes Aircraft Company, Electronic Properties Information Center. D. L. Grigsby. April 1967. 64 pages.

AD–810 374

BORON

Hughes Aircraft Company, Electronic Properties Information Center. John T. Milek, and Sheldon J. Welles. February 1967. 266 pages.

AD–810 423

LEAD OXIDE

Hughes Aircraft Company, Electronic Properties Information Center. M. Neuberger. May 1967. 84 pages.

AD–814 147

Each of these reports is comprised of a compilation of a wide range of electronic and other physical properties of the material under consideration. Included is the available information on crystallographic, electrical, optical, thermal, thermodynamic, energy band, and other properties. Each property is compiled over the widest possible range of parameters, and the data are presented largely in the form of tables and graphs. The report on boron, in addition, provides a review of methods of preparation and fabrication. A bibliography of source literature is included in each document.

Inorganic Chemicals
(continued)

NIOBIUM TIN. Part I.

Hughes Aircraft Company, Electronic Properties Information Center. D. L. Grigsby. January 1968. 158 pages.

AD–830 330

NIOBIUM TIN. Part II.

Hughes Aircraft Company, Electronic Properties Information Center. D. L. Grigsby. July 1968. 180 pages.

AD–838 460

Until recently most work on niobium tin was done primarily to gain an understanding of its basic properties. However, there is at present a number of practical applications of this material and even more are projected for the future. These documents provide a compilation, in graphic and tabular form, of the properties of this material over the widest range of parameters. Part I involves structure sensitive properties: Thermal conductivity, critical current, current density, solenoid device applications, etc. Also, the properties of niobium-tin-x ternary compounds are presented. Part II deals with structurally insensitive properties, including phase diagrams, crystallographic properties, specific heat, transition temperature, magnetic properties, penetration depth, and electrical resistivity.

———o———

TRANSPLUTONIUM ELEMENTS. A BIBLIOGRAPHY

United States Atomic Energy Commission, Office of Information Services. Charles E. Stuber. October 1972. 129 pages.

TID–3317–SUP–3

This bibliography contains abstracts of 757 articles and reports concerning the transplutonium elements (*i.e.*, those with Z greater than 94). The first section of the bibliography deals with the production of these elements and their chemical, nuclear, and physical properties. The second section deals with attempts to locate or prove the existence of the transplutonium elements in nature. Subject and author indexes are included.

———o———

Process Engineering

PROCESSES FOR LOW TEMPERATURE DEEP DEWAXING OF MINERAL OIL

Pennsylvania State University, Department of Chemical Engineering. Paul Barton, E. Erwin Klaus, and Elmer J. Tewksbury. May 1969. 205 pages.

AD–854 377

The deep dewaxing step in the production of super-refined mineral oils is by far the most costly of the processing steps. Until now, dewaxing and the unit operations involved in this process have received less attention than any of the other petroleum processing steps designed to upgrade the quality of petroleum derived lubricants. This report gives the results of a two-year program to devise improved deep dewaxing processes. The program involved bench and pilot scale demonstration of the crystallization and filtration steps, and application of the resulting data to process design and economics for commercial production of deep dewaxed fluids. The work indicates that low-temperature mineral oils could be competitive with certain synthetics on the basis of processing costs. Functional fluids for certain automotive and industrial applications also can be prepared in the same processing equipment within a competitive price range.

CYCLIC OPERATION OF PLATE COLUMNS FOR GAS-LIQUID CONTACTING

Massachusetts Institute of Technology, Department of Civil Engineering. James D. Dearth, Lawrence B. Evans, and Edwin R. Gilliland. May 1972. 75 pages.

PB–211 853

Increased process efficiency and equipment capacity are among the benefits which can result from the controlled cycling of many traditionally steady-state chemical engineering operations. Because of the widespread use of gas-liquid contacting equipment in industry for distillation or gas absorption applications, it is felt that the introduction of controlled cycling into this area may have a substantial impact upon the economics of any process which utilizes these unit operations for purification or product recovery. This report is concerned with certain aspects of the design of staged gas-liquid contacting equipment for cycled operation. Emphasis is on column hydraulics.

Waste Processing and Materials Recovery

ADVANCES IN SOLID WASTE TREATMENT TECHNOLOGY

Grumman Aerospace Corporation. Alex Hershaft. August 1972. 89 pages.

AD–749 409

Solid waste treatment technology deals with equipment and techniques for removal, processing, and reclamation or disposal of solid wastes generated by residential, commercial, industrial, agricultural activities. This document provides a survey of recent advances in this field of technology, with ample references to more definitive sources of information. Specific topics covered include storage, collection, transportation, fragmentation, sorting, bulk reduction (baling, incineration), conversion (pyrolysis, composting, etc.), reclamation, mining, and agricultural wastes, and disposal (land and sea).

DISPOSAL OF CELLULOSIC WASTE MATERIALS BY ENZYMATIC HYDROLYSIS

Army Natick Laboratories. Mary Mandels, Lloyd Hontz, and Dixon Brandt. 1972. 16 pages.

AD–750 351

Cellulosic materials often form a large component of municipal solid wastes. This document summarizes studies undertaken at Natick Laboratories on the conversion of cellulose from this source into useful products. It is known that cellulose can be quantitively converted to glucose by acid or enzymatic hydrolysis. The approach taken in the present case involves the use of the cellulose produced by *Trichoderma Viride*. Experimental reactors and columns have been operated continuously at 50°C for several weeks with minimal enzyme replenishments. The product glucose, which is a nearly universal growth substrate, can be consumed by man, fed to animals as molasses, converted to single cell protein, or used as a raw material for fermentation to alcohol, amino acids, drugs, or other useful chemicals.

* * *

PAPER AND WOOD PACKAGING IN SOLID WASTE

National Industrial Pollution Control Council. July 1972. 24 pages.

COM–72–50745

Paper, paperboard, and wood account for a large proportion of the materials currently used in packaging; consequently, these materials represent a considerable solid waste problem, both potential and real. This report deals with the relationship of paper, paperboard, and wood containers to solid waste management, and outlines actions necessary to correct the disposal problems of paper and wood packaging. Emphasis is placed on recycling these waste products, and the production of virgin products that are easily recyclable.

* * *

CONCEPTUALIZED FLY-ASH AND SULFUR DIOXIDE SCRUBBING SYSTEM WITH BY-PRODUCT RECOVERY

Babcock and Wilcox Company, Power Generation Division. Gary E. Carlson, and David E. James. January 1971. 18 pages.

PB–210 354

A system was designed to remove 99% of the fly-ash and 97½% of the sulfur dioxide contained in a typical flue gas. A venturi-type scrubber is used to remove the fly-ash, and a tray type absorber is used for sulfur dioxide absorption. Commercially available equipment is employed wherever possible. The adsorbent is regenerated, and the sulfur dioxide is recovered in a form suitable for producing concentrated sulfuric acid. This document describes the system and provides engineering drawings and cost estimates of the equipment.

* * *

DEVELOPMENT OF THE CATALYTIC CHAMBER PROCESS

Tyco Laboratories, Inc. A Gruber, and A. Walitt. October 1970. 157 pages.

PB–210 651

The Catalytic Chamber Process is aimed at solving one of the most pressing air pollution problems: The emission of enormous quantities of sulfur dioxide and nitrogen oxides into the atmosphere from the stacks of power plants burning fossil fuels. Essentially, the process accomplishes the removal of sulfur dioxide by oxidation with nitrogen dioxide followed by adsorption of the resulting sulfuric acid and oxides of nitrogen in a recycle stream of sulfuric acid. The nitrogen oxides are recovered by catalytic stripping of the sulfuric acid; the net nitrogen dioxide recovered is converted to nitric acid; and the bulk of the nitrogen dioxide is recycled for further sulfur dioxide oxidation. This report provides the results of an effort which confirmed the technical feasibility of the catalytic chamber process, and obtained engineering design data for process scale-up. Some of the topics covered include: Selection of catalyst; evaluation of activated charcoal; operation of a laboratory scale high-temperature scrubber; determination of the vapor pressure of nitrogen oxides over $HNSO_5/H_2SO_4$ solutions; operation of an integrated 10 SCFM unit; process economics.

* * *

EFFECTIVE SYSTEMS OF SCRAP UTILIZATION: COPPER, ALUMINUM, AND NICKEL

Pennsylvania State University, College of Earth and Mineral Sciences. Richard L. Gordon, Wilfrid A. Lambo, and George H. K. Schenck. July 1972. 230 pages.

PB–210 795

The utilization of solid waste as a raw material, a resource which can be converted into new and useful products by recycling, is growing in practice. Nonferrous scrap metals have become particularly promising in this regard. The document is concerned with materials designated as secondary metals, those which have been recovered, processed, and now are made ready for use in industry. They are obtained from two classes of scrap, one originating from commodity manufacture, and the other obtainable by recycling. There is no direct relation to quality, purity, or physical characteristics. A report is made on three metals, copper, aluminum, and nickel, which furnish a reasonable cross section of conditions in the secondary metal market. Economic and technical factors are discussed, along with decision making and the construction of management models.

* * *

THE COLLECTION OF NONFERROUS SCRAP: A LITERATURE REVIEW OF THE COPPER AND ALUMINUM SECTORS

Pennsylvania State University, College of Earth and Mineral Sciences. Richard L. Gordon, George H. K. Schenck, and Wilfrid A. Lambo. July 1972. 85 pages.

PB–210 833

In the domain of materials, concern is growing on two issues: diminution or exhaustion of known natural resources and the disposal of solid wastes. A partial solution to both of these appears to be the utilization of secondary materials, those recovered from wastes, recycled and made reusable in industry. The report seeks to advance understanding of the use of nonferrous scrap, with especial attention to copper and aluminum. A literature review was made on operations in the scrap industry with regard to these metals, and a discussion is given of the statistical data, technology methods and problems, scrap type and age, and smelter characteristics. Some distinctions are observed between copper and aluminum data, and economic factors are noted, particular with respect to demand and supply.

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THE PESTICIDE MANUFACTURING INDUSTRY—CURRENT WASTE TREATMENT AND DISPOSAL PRACTICES

University of Texas. Patrick R. Atkins. January 1972. 190 pages.

PB–211 129

The wastes produced by the numerous pesticide manufacturing processes in current existence are varied and possess characteristics which make them unique. This document provides a review of the state of the art of the waste treatment practices utilized by the industry to manage these wastes. It contains information on current and predicted pesticide production trends, a description of typical pesticide manufacturing processes, a review of the literature which describes pesticide chemistry and waste treatment practices, and cost estimates for various waste treatment methods.

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ESTIMATING COSTS AND MANPOWER REQUIREMENTS FOR CONVENTIONAL WASTEWATER TREATMENT FACILITIES

Black and Veatch, Consulting Engineers. W. L. Patterson, and R. F. Banker. October 1971. 250 pages.

PB–211 132

This report presents cost estimating data and manpower requirements for major components of conventional wastewater treatment plants. Major plant components included are typically raw wastewater pumping stations, sedimentation basins, trickling filters, digesters, sludge dewatering, sludge incineration, and other facilities. Costs and manpower estimates for each component are related to a single parameter for sizes of individual facilities appropriate to treatment plants ranging in capacity from 1 to 100 million gallons per day. The estimating data presented are appropriate for average conditions and, when used with judgment regarding specific local situations, should permit development of adequate preliminary estimates for conventional treatment facilities.

EVALUATION OF PROCESSES AVAILABLE FOR REMOVAL OF PHOSPHORUS FROM WASTEWATER

Lawrence K. Cecil. October 1971. 44 pages.

PB–211 191

In order to prevent accelerated eutrophication of lakes and streams, control must be effected over plant nutrients in waste water. Of the major nutrients other than carbon, phosphorous is the one most easily controlled. There is an enormous and sometimes confusing literature on the many processes for phosphorus removal. This document provides a review of that literature. An evaluation is given of the practicality, cost, and impact on the quality of the treated effluent for the various processes. The options available to the designer for the selection of treatment processes, chemicals to be used, and the point of chemical application are discussed. Consideration is also given to methods of ultimate sludge disposal.

WATER POLLUTION REDUCTION THROUGH RECOVERY OF DESIZING WASTES

North Carolina State University, Department of Textile Chemistry. Carl E. Bryan. January 1972. 50 pages.

PB–211 245

Removal of the size with which the warp yarns are coated to make the weaving of the fabric possible is a common operation in the preparation of cloth for dyeing and finishing. The traditional warp size for cellulosic textiles is starch and modified starches. In recent years certain water-soluble, synthetic polymers, such as carboxymethyl cellulose and polyvinyl alcohol, have been introduced. These materials contribute heavily to the waste load from textile finishing operations. A process for recovering carboxymethyl cellulose from desizing wastes by precipitation with aluminum sulfate (filter alum) has now been developed on a laboratory scale. Considerable testing indicates that the process may have practical applications, since the recovered material may be suitable for use as a warp size. A similar process for recovering a modified polyvinyl alcohol was also developed.

ENERGY POTENTIAL FROM ORGANIC WASTES: A REVIEW OF THE QUANTITIES AND SOURCES

Bureau of Mines. Larry L. Anderson. July 1972. 20 pages.

PB–211 249

Productive economics are dependent, to a large extent, on the availability of abundant, inexpensive energy. The major portion of this energy is now provided by fossil fuels; however, the reserves of these fuels are expected to decline severely in the next 30 years. Another source of energy is available from material that is becoming an overwhelming pollution and nuisance problem. Unlike coal, gas, and oil, this source is continuously replenishable. It is the organic waste material produced by industry, livestock, and the population in general. This report itemizes and evaluates for the first time in detail the quantities and sources of moisture- and ash-free organic material available from these sources. Estimates are provided for amounts of organic waste collected or concentrated, and for the fuel potential of these wastes.

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REVIEW OF THE DRY LIMESTONE INJECTION PROCESS

M. W. Kellog Company. A. G. Sliger, J. A. Bellott, and G. M. Drissel. May 1972. 280 pages.

PB–211 431

The "Dry Limestone Process" was developed by the Tennessee Valley Authority as a means of reducing SO_2 emissions from coal-fueled power plants. The process, which can be applied to existing plants, involves the injection of finely powdered limestone or Dolomite into the fire box of the boiler, where the solid particles decompose, forming calcium oxide. This reacts with sulfur dioxide and with excess oxygen, forming calcium sulfite and calcium sulfate. The reaction product is collected with the fly ash in dust collection equipment. This report provides an assessment of dry limestone process technology and an up-date of the design bases originally used by the TVA to reflect more recently developed process information. Design recommendations are given wherever possible.

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PRIMARY CONSIDERATIONS IN REGIONAL WASTEWATER TREATMENT PLANNING

Mississippi State University, Water Resources Research Institute. Adnan Shindala. June 1972. 43 pages.

PB–211 465

The deterioration in the quality of surface waters associated with the disposal of the ever increasing quantities of wastewater resulting from a rapid population growth and industrial revolution has heightened concern with respect to the conservation of water resources. Recently, the concept of regionalization has been suggested as the most effective route of achieving desired water quality goals at a minimum cost. The selection and implementation of an optimum regional plan for wastewater treatment requires a full and thorough consideration of existing and future water quality goals, sources of pollution, treatment levels, transmission facilities, and final disposal methods. Several alternative systems must be evaluated along with associated costs to insure that the selected plan best satisfies the needs and desires of the region. This report presents an approach for selecting a plan for wastewater treatment and disposal which minimizes the treatment cost in the region. This is accomplished through identification and isolation of the critical factors that constitute the input in selecting an optimal plan from among the complex alternatives in obtaining water quality goals.

A STUDY OF THE LIMESTONE INJECTION WET SCRUBBING PROCESS. VOLUME I.

Radian Corporation. November 1971. 140 pages.

PB–211 748

A STUDY OF THE LIMESTONE INJECTION WET SCRUBBING PROCESS. VOLUME II.

Radian Corporation. November 1971. 111 pages.

PB–211 749

A STUDY OF THE LIMESTONE INJECTION WET SCRUBBING PROCESS. VOLUME III.

Radian Corporation. November 1971. 138 pages.

PB–211 750

There are several methods for controlling sulfur dioxide emissions. Limestone based scrubbing processes are presently the most technically promising for control of fossil fuel power plants. A mathematical model has been developed to study the chemistry of the process. In the first volume, results of process variables upon the sulfur dioxide removal are reported. In the second volume, the model is described, and some thermodynamic properties of solutions computed. Finally the third volume gives the three computer programs used to analyze the variables in this scrubbing process.

A LITERATURE SEARCH AND CRITICAL ANALYSIS OF BIOLOGICAL TRICKLING FILTER STUDIES.
VOL. I

Dow Chemical Company, Functional Products and Systems Department. December 1971. 330 pages.

PB–211 909

A LITERATURE SEARCH AND CRITICAL ANALYSIS OF BIOLOGICAL TRICKLING FILTER STUDIES.
VOL. II

Dow Chemical Company, Functional Products and Systems Department. December 1971. 367 pages.

PB–211 910

The efforts of many thousands of people working on biological trickling filters at the laboratory, pilot plant, and field scales, along with the subsequent reporting of the results, have created a tremendous volume of information. To delve into the background literature requires considerable time and effort, and is not always practical or feasible. Thus, this literature review and critical analysis were undertaken in an attempt to provide a source of trickling filter information to all technically interested individuals in this rapidly expanding field. Volume I is the literature review and critical analysis of selected articles. It is organized in four technical parts: (1) Introduction, definitions, history, and background theory of the trickling filter process; (2) Plant design, materials of construction, operation, maintenance, and performance; (3) trickling filter research and development approaches, ecology, and patents; (4) Applications of trickling filters to specific industrial wastes. Volume II is a bibliography of 5,665 references to the international literature.

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RECOVERY OF PHOSPHATES AND METALS FROM PHOSPHATE SLUDGE BY SOLVENT EXTRACTION

Bureau of Mines, Rolla Metallurgy Research Center. Howard E. Powell, Lawrence L. Smith, and Andrew A. Cochran. August 1972. 17 pages.

PB–211 933

The phosphate coating of metals is widely used in industry, especially in the manufacture of steel products. The primary use of phosphate coating is to provide a base to which paint or enamel will strongly adhere, but it is also used for corrosion protection and for lubrication in die forming operations. Chemical reactions during the phosphating operation result in the accumulation of an insoluble sludge. It has now been found that these waste phosphate sludges can be successfully treated by solvent extraction techniques to produce separate zinc, iron, and trisodium phosphate products. Zinc recoveries are about 98%, and iron recoveries are nearly 100%. The value of marketable products is considerably more than the main reagent costs. Details of the process are provided in this report.

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SEPARATION OF COLUMBIUM, TANTALUM, TITANIUM, AND ZIRCONIUM FROM TITANIUM CHLORINATION RESIDUES

Bureau of Mines, Boulder City Metallury Research Laboratory. C. C. Merrill, and D. E. Couch. 1972. 12 pages.

PB–211 935

It is known that the water-soluble portion of the waste resulting from the chlorination of rutile contains chloride and chloride-oxide complexes of Nb, Ta, Ti, Zr, Al, Cr, Fe, V, and minor amounts of other elements. The insoluble wastes can be recycled to produce $TiCl_4$. This report describes a method whereby Nb, Ta, Zr, and Ti can be recovered from the water-soluble fraction. The waste is leached and filtered; pressure hydrolysis then gives the above metals as a white precipitate. Solvent extraction using a secondary amine gives a final separation of the individual elements.

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RECONDITIONING OF FOOD PROCESSING BRINES

National Canners Association Research Foundation, Western Research Laboratory. March 1971. 77 pages.

PB–212 394

A method is described for reconditioning storage brines and processing waters from the production of canned and glass packed olives. It was found possible to use the reconditioned storage brines to store freshly harvested olives for commercially significant periods. Canned samples prepared from olives stored in reconditioned brines were of good quality. Reconditioned brines of lower salt content could be reused with no detectable effect on the final product. The report describes the design, construction, and operation of the process equipment, and then gives the results of an evaluation and economic analysis of the process.

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Bituminous Materials

INFLUENCE OF MINERAL FINES ON AGING OF ASPHALT AND RELATED STUDIES

Phillips Scientific Corporation. D. W. Cagle, and H. L. Draper. July 1972. 239 pages.

AD–749 969

Mineral fines are present or are added as filler to all asphalt paving mix compositions. The fines are necessary to make a dense, impermeable pavement structure. The fines portion of a pavement is one of the most critical areas to consider in preparing a pavement for long life expectancy, yet is one of the variables most often overlooked and least understood. This study attempts to elucidate aspects of the response of fines and fillers to the asphalt cement binder and their relation to improved pavement life. The information is presented in such a manner that the engineer in the field can better understand the function of fines in asphaltic concretes and better exercise control measures to benefit the construction.

BASIC PROPERTIES OF PAVEMENT COMPONENTS

University of California (Berkeley). C. L. Monismith, R. G. Hicks, and Y. M. Salam. September 1971. 202 pages.

PB–212 032

Pavement design requires that the engineer have the ability to analyze a pavement structure in terms of realistic parameters, parameters which permit an estimate of performance to be assessed in some significant manner. While a general performance function which relates distress to performance is not available, it is possible to predict specific distress modes and to make judgments as to how each might influence the performance of the pavement structure. This report gives the results of two studies aimed at providing this sort of information. The first of these concerned the defining of the properties of granular materials which contribute to deflections of asphalt pavements under moving traffic. The second study sought to define some of the factors influencing the ultimate properties of asphalt concrete in tension and to use the ultimate characteristics so defined in the solution of typical engineering problems where a knowledge of such characteristics would be required.

DEVELOPMENT OF A HIGH-STRENGTH BERYLLIA MATERIAL

Army Materials and Mechanics Research Center. Jacob Greenspan. June 1972. 16 pages.

AD–748 389

This report describes an approach for the strengthening of beryllia, following a mode apparently of grain refinement strengthening. The method involves hot-pressing or pressure sintering of beryllia powders blended with a minor but certain sufficient amount of alumina powders, such that the constituents combine chemically with each other and thereby aid the sintering process. The important temperature and time parameters for pressure sintering by this method are significantly less than those normally required for beryllia. A relatively high strength is exhibited by the resultant material which is beyond that which is usual for beryllia-base materials, and which in this respect represents an advance in the existing technology.

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A HIGH-TEMPERATURE ENGINEERING CERAMIC (Si_3N_4) BY POWDER METALLURGICAL METHODS

Army Materials and Mechanics Research Center, Ceramics Division. Michael W. Lindley, and R. Nathan Katz. June 1972. 10 pages.

AD–750 096

Silicon Nitride (Si_3N_4) has been seriously investigated and used as an engineering material in the last few years. Reaction-bonded silicon nitride in essence is not a single material but encompasses a spectrum of materials with various property characteristics, and with the ability to be fabricated by differing processing techniques. This review discusses the application of powder metallurgical techniques to the fabrication of reaction-bonded silicon nitride, the nitridation process, and the resultant properties.

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A CRITICAL SURVEY OF CHARACTERIZATION OF PARTICULATE CERAMIC RAW MATERIALS

University of California (Berkeley), Department of Mineral Technology. E. R. Stover. May 1967. 103 pages.

AD–816 014

Characterization of raw materials is a recognized need for the improvement in the control of structure and composition of ceramics. The goal of this survey report is to indicate how the problem of characterization might be approached and the kinds of information which must be acquired before any real value can be obtained from serious attempts at characterization. The first section contains suggestions for possible improvements in the identification and classification of fundamental characteristics, the approaches to characterization, and the optimum use of methods in order that a more exact approach to processing might be achieved. This is followed by a section reporting the results of a survey of persons in the field concerning the problems and need in the area of ceramic raw material characterization. A simple method for a general fundamental description of composition and structure in complex materials is suggested and applied by example to particulate ceramic materials. Finally, an evaluation is provided of specific characterization techniques. A bibliography of 228 entries is included.

Ceramics (continued)

Composite Materials

RESIN CONCRETES: A LITERATURE REVIEW

Army Engineer Waterways Experiment Station. J. E. Dennard, Jr. September 1972. 29 pages.

AD–750 101

The term resin concrete, as used in this survey, refers to a construction material composed of an aggregate bound in a synthetic resin matrix (such as epoxy or polyester). Among the unique properties of these materials are their high tensile, shear, bond, and compressive strengths, adjustable modulus of elasticity, high corrosion resistance, low permeability, rapid strength development, excellent insulation properties, etc. Costs are higher than those for conventional concretes, but they are being used with increasing frequency in application where their special characteristics offer a definite advantage. This document provides a review of the state of the art of resin concrete preparation and application.

FILAMENTS, FIBERS, AND METAL MATRIX COMPOSITES

Air Force Materials Laboratory, Metals and Ceramics Division. J. A. Herzog. October 1967. 53 pages.

AD–825 160

Metal matrix composites offer exciting new opportunities for exercising greater control over the properties of materials. Such composites extend the properties and capabilities of reinforced composite materials beyond those available in polymeric matrix composites. The basic concept for strengthening of metal matrices is the application of strong fibers participating in load transfer as the primary member in the combination. This report provides a compilation of observations and data on the relevant properties of some of the more interesting filaments, fibers, and fiber crystals for this purpose. These include boron and silicon carbide filaments, carbon and boron nitride fibers, and sapphire and silicon carbide crystals. The properties considered are: Surface morphology; mechanical properties; fracture behavior; and interactions between the fiber and the matrix. In addition, attention is given to processing techniques for combining fiber and matrix into an integral unit, and to the mechanical behavior of several metal matrix composites.

STRUCTURAL PLASTICS APPLICATIONS HANDBOOK

Lockheed Palo Alto Research Laboratory. William G. Jurevic, and John B. Rittenhouse. August 1968. 242 pages.

AD–840 585

STRUCTURAL PLASTICS APPLICATIONS HANDBOOK. SUPPLEMENT I. TEST METHODS

Lockheed Palo Alto Research Laboratory. William G. Jurevic. June 1969. 50 pages.

AD–858 389

Information is provided on resins and reinforcements that are used in making structural reinforced plastics. The basic handbook includes information and data on various properties of resin reinforced systems, and general information on filament winding, tape wrapping, and machining. Designations, specifications, composition, forms available, and chemical, mechanical, and physical properties are included. The supplement contains procedures used for characterizing and evaluating structural plastic composites and their component parts.

DEVELOPMENT OF A METHOD OF CONCENTRATING HIGH MODULUS, OPEN-END FIBERS INTO A YARN

Monsanto Research Corporation. Myrne R. Riley. April 1972. 46 pages.

AD–894 686

DEVELOPMENT OF A METHOD AND APPARATUS FOR SPINNING A YARN OF HIGH MODULUS FIBERS

Monsanto Research Corporation. Myrne R. Riley. April 1972. 60 pages.

AD–894 712

For stiffness-limited applications, the most efficient utilization of high modulus, discontinuous reinforcements in a composite material is obtained when the fibers are aligned parallel to a principal axis. However, one of the major shortcomings in the field of composite materials is the absence of methods to package short stiff fibers in collimated form suitable for filament winding and related composite fabrication procedures. These documents describe a vortex spinning process which is capable of producing a multi-component yarn which is suitable for this purpose. The design of the apparatus was based on developments in the textile industry to produce yarn by means of open-end spinning. Fiber-reinforced epoxy composites formed using yarn produced by the vortex method has mechanical properties comparable to values obtained with extruded discontinuous fiber composites.

TENSILE FAILURE CRITERIA FOR FIBER COMPOSITE MATERIALS

Composite Materials
(continued)

Materials Sciences Corporation. B. Walter Rosen, and Carl H. Zweben. August 1972. 167 pages.

N72–30499

Practical fiber composite materials contain fibers which exhibit a high but variable strength. This variation of fiber strength, coupled with the existence of a relatively weak matrix material and large interfacial areas, creates a material in which there are a multiplicity of potential failure paths. Attempts to represent this material as a homogenous continuum for the study of tensile failure are unrealistic. An improved analytical model of the tensile strength of fiber composites has now been developed. It provides an insight into the failure mechanics of the materials and defines criteria which may serve as tools for preliminary design material selection and material reliability assessment.

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CEMENT DURABILITY PROGRAM, LONG-TERM FIELD EXPOSURE OF CONCRETE COLUMNS

Concrete
(Nonbituminous)

Army Engineer Waterways Experiment Station, Concrete Laboratory. E. C. Roshore. August 1972. 44 pages.

AD–747 355

Concrete columns of various cement and aggregate compositions were exposed to outdoor tidal weathering environments on the coasts of Maine and Florida for periods of up to 30 years. The objective was to develop information about the manufacture, composition, and durability of these cements. The final results of the investigation are presented in this report.

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THE DYNAMIC BEHAVIOR OF CONCRETE

Systems, Science and Software. H. E. Read, and C. J. Maiden. August 1971. 61 pages.

AD–894 240

A review is provided of current knowledge concerning the mechanical behavior of concrete, particularly in regard to rapid, impulsive loading. Topics such as shock wave propagation and spallation are given special consideration. Research programs related to the dynamic response characteristics of concrete are reviewed and discussed. Finally, coefficients for an existing constitutive model for porous materials are determined from the experimental data reviewed. Numerical results based on this model and on an existing elastic-plastic model are given for several shock loading problems, and comparisons with corresponding experimental data are presented.

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THE CORROSION OF METALS IN MARINE ENVIRONMENTS

Battelle Memorial Institute. F. W. Fink and W. K. Boyd. May 1970. 97 pages.

AD–712 585

In selecting a metal for application in an ocean environment, the marine engineer must be cognizant of the corrosion behavior of that metal under various conditions of atmosphere, splashing, tides, immersion, deep sea submergence, and mud. He will remember that good resistance to one environment does not predict similar resistance in another, especially since only a few metals can resist all marine environments. This review discusses the relevant properties and behavior of low alloy and stainless steels; nickel, copper base, aluminum, and titanium alloys; titanium; beryllium; and magnesium; and coatings of zinc, cadmium, lead, and silver. A discussion of cathodic protection and control measures is included.

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CORROSION FATIGUE OF METALS AND ALLOYS

Rensselaer Polytechnic Institute. D. J. Duquette. May 1972. 118 pages.

AD–742 461

Corrosion fatigue may be defined as the combined action of an aggressive environment and a cyclic stress leading to premature failure of metals by cracking. This document provides a review which underlines certain key issues in the early work on corrosion fatigue and emphasizes recent data and theories of the mechanisms of corrosion fatigue. Emphasis is placed on the critical processes which govern corrosion fatigue mechanisms. In particular, the effects of gaseous and aqueous environments on ultimate corrosion fatigue failure, and the success of protective measures are reviewed; an effort is made to correlate both initiation and propagation processes.

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BEHAVIOR OF MATERIALS IN A SUBSURFACE OCEAN ENVIRONMENT

Naval Research Laboratory. L. A. Beaubien, I. Wolock, C. L. Buchanan, and C. L. Whitman. July 1972. 111 pages.

AD–747 245

This document provides a survey of the state of knowledge of the effect of seawater on a large class of materials and components. The first section is a critical review of the effects of seawater on plastics, elastomers, and composite materials. This is followed by a similar review concerning ceramics, paper and documents, fabrics and fibers, photographic materials, magnetic tape, and electronic components. Finally, an annotated bibliography of 297 entries is given on the corrosion of metals in seawater.

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PROCEEDINGS OF THE 17th MEETING OF THE MECHANICAL FAILURES PREVENTION GROUP

Rensselaer Polytechnic Institute. W. T. Sawyer (Editor). November 1972. 92 pages.

AD–750 411

The mechanical Failures Prevention Group is an informal, voluntary association of technical specialists from industry, educational institutions, and government. Its activities are sponsored by several U.S. Government agencies to serve the interests of all federal agencies concerned with the reduction of incidence and consequence of mechanical failures. This document is comprised of 15 papers presented at a meeting of the group held in April 1972. The theme of the meeting was the effects of environment upon mechanical failures, mechanisms, and detection. The topics of the individual papers include: Adsorption-sensitive fracture of solids; effect of carbonaceous gas environments on the corrosion of high-strength steel; general framework of understanding stress corrosion cracking; corrosion fatigue; effects of temperature and environment on subcritical crack growth; solvent crazing in glassy polymers and swelling in filled elastomers; corrosion prevention and wear protection properties of polymeric coatings; environmentally inducted failures in the lubrication of marine machinery; characterization of miniature ball bearings by acoustic signature analysis; instrumentation to detect foreign object damage in jet engines; mechanisms concerned with the effect of the environment on stress corrosion cracking; stress corrosion cracking of steam turbine materials; environmental effects on mechanical failure involving particularly multiphase flows.

INTRODUCTION TO CORROSION CONTROL DESIGN

Battelle-Northwest. Lyle D. Perrigo. 1972. 36 pages.

BNWL–SA–3817 (Rev. 1)

During the design of various systems, buildings, and equipment, action should be taken to avoid corrosion problems in subsequent periods of operation by proper specification of materials and the use of anti-corrosion design principles. The former is a common consideration in most design efforts; the latter is equally important but frequently receives little attention. This document reviews some simple and straightforward design principles which will permit the reduction or avoidance of operational corrosion problems. These principles are concerned with promoting the use of orientation, layout, and configuration to avoid the holdup of solutions, abrupt flow changes, impingement, and stagnant areas. Emphasis is given to the importance of climatic conditions and terrain as siting in reducing atmospheric corrosion of buildings and facilities. (This document is a revision of *The Role of Design in Corrosion Prevention,* BNWL-SA-3817, described in AMTID, April 1972, page 40.)

Fibers and Textiles

UNITED STATES AND CANADIAN FABRIC FLAMMABILITY STANDARDS

National Bureau of Standards, Fire Technology Division. Richard G. Katz. October 1972. 57 pages.

COM–72–50993

This report describes the current flammability standards of the Governments of Canada and the United States. The goods covered by these standards include children's sleepwear, bedding, mattresses, and carpets and rugs. Also included are reprints of the Canadian Hazardous Products Act and the U.S. Flammable Fabrics Act, both with their applicable amendments. This document may be of interest to those desiring to export to Canadian and U.S. Markets, as well as those concerned with the development of similar standards.

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Lubricants

BOUNDARY LUBRICATION

Esso Research and Engineering Company. Alan Beerbower. June 1972. 353 pages.

AD–747 336

Boundary lubrication is that lubrication regime in which there is some contact between opposing surfaces, but in which most of the load is carried by a lubricating film. This document provides a review of the current state of knowledge of boundary lubrication and presents the prospects of such improvements in the lubrication of highly-loaded bearings as virtually to eliminate bearing failures. The advances reported are such as to make realistic the hope of virtual elimination of the relubrication of machinery during the expected lifetime of the equipment. The survey uncovered 28 anomalies, or phenomèna inexplicable in the state of knowledge currently available to designers in the performance of lubricants. Models are constructed which are able to explain 27 of these anomalies. A plan for applying this knowledge to design practice is outlined.

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DEVELOPMENT OF IMPROVED CUTTING FLUIDS AND LUBRICANTS

General Electric Research and Development Center. R. W. Roberts, P. E. McElligott, R. S. Owens, *et al.* March 1969. 181 pages.

AD–849 715

This report provides the results of a program aimed at improving the metal-removal processes for nickel-base alloys based on an identification and development of improved cutting fluids. The main approach to the problem was to gain an understanding of the chemical nature of freshly generated metal surfaces, and then to correlate this knowledge with the phenomena occurring in actual friction and wear or machining situations. This permitted the synthesis of potential lubricants or cutting fluids with a better knowledge of what may occur at the newly generated surfaces in the

Lubricants
(continued)

metalworking process. The main result of this effort was the identification of a cutting fluid system that is stable, nontoxic, and noncorrosive when properly used and which yields superior results in metal removal processes involving nickel-base alloys. The system consists of tightly bound iodine in a hydrocarbon molecule with additives and a filter system to control corrosion.

HIGH TEMPERATURE EXTRUSION LUBRICANTS

TRW, Inc. J. D. Hostetler, and C. R. Cook. January 1969. 121 pages.

AD–853 238

The advantages of extrusion over other metalworking techniques for the production of precision structural shapes include better recovery, lower costs, the ability to produce complex shapes not attainable by any other method, and the ability to attain large uniform reductions almost entirely in compression. The utilization of this method for some alloys is, however, inhibited by the lack of suitable extrusion lubricants. This report provides the results of a study which was made of a large number and variety of materials to determine their applicability as extrusion lubricants. The materials included many inorganic compounds, combinations of metal oxides and graphite, several organic compositions, new phosphorus based compositions, new combinations of metals with phthalocyanines, and proprietary combinations. The properties desired included low friction characteristics, stability at high temperatures and pressures, low reactivity with designated billet and die materials under extrusion conditions, low thermal conductivity, and the ability to be applied with adequate adherence to the extrusion tooling. The lubricants which received a satisfactory rating in laboratory tests were then evaluated in the extrusion press with steel, molybdenum alloy, and titanium alloy. Of the 470 candidate lubricants screened, 4 provided excellent service with the above alloys.

Metals and Alloys

SUPERALLOYS—PROCESSING. PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE

Battelle Columbus Laboratories, Metals and Ceramics Information Center. September 1972. 530 pages.

AD–748 159

Superalloys may be broadly defined as alloys with excellent oxidation resistance for service at high-stress levels at temperatures exceeding 650°C. This book is comprised of the full text of each of the 28 papers presented at the Second International Conference on Superalloys—Processing. It includes both review papers and research reports on the following topics: Recent melting and refining process developments; electroslag remelting; investment casting; elimination of casting defects; hot working; alloying; heat treatment; cold reduction; component fabrication welding and fastening; alloy properties; embrittlement; powder metallurgy.

WORKABILITY TESTING TECHNIQUES

TRW Inc. A. L. Hoffmanner. June 1969. 176 pages.

AD–860 366

The usual application of the term workability implies the ability of an alloy to be successfully deformed in a practical metalworking process. In addition to a material's ability to deform, however, consideration must also be given to the conditions of stress, strain rate, and temperature imposed on the material by the process. This report gives the results of an evaluation of workability tests which was performed to establish a procedure for rating the work material's contribution to workability. It was demonstrated that the fracture strain dependence on stress and anisotropy can be determined from two test results at a particular strain rate and temperature. Understanding of this relation can lead to marked improvements of workability by utilizing process modifications which produce desirable geometric changes of the microstructure. A workability rating system, based on this relationship, is proposed. It is felt that by using this system to rate new alloys relative to the processing observations of more conventional alloys, processing results can be predicted without the necessity for costly process development.

THERMO-MECHANICAL PROCESSING AND FATIGUE OF ALUMINUM ALLOYS. A REVIEW

Air Force Materials Laboratory, Metals and Ceramics Division. F. Ostermann, and W. H. Reimann. October 1969. 50 pages.

AD–863 211

In the past, aluminum alloy development has concentrated successfully on the achievement of high static strength, but has resulted in little improvement in fatigue properties. One approach to the problem of fatigue improvement is the use of thermo-mechanical treatments. This paper reviews the possibilities of applying this approach to the age-hardening aluminum alloys. In the first part, consideration is given to the various processes that participate in the development of fatigue cracks in metals and alloys in general, examines the influence of the existing microstructure on each of the stages involved, and attempts to isolate from this evidence the important features which appear to control each stage. Next the important aspects of age-hardening and deformation of aluminum alloys are reviewed. Finally, the available and relevant literature on thermo-mechanical treatments of age-hardening aluminum alloys is discussed. A bibliography of 112 items is provided.

PLANE-STRAIN FRACTURE-TOUGHNESS DATA FOR SELECTED METALS AND ALLOYS

Battelle Memorial Institute, Defense Metals Information Center. J. E. Campbell. June 1969. 33 pages.

AD–865 426

Plane-strain fracture-toughness (K_{Ic}) parameters may be used to estimate critical flaw sizes in structural metals to known stresses at specified temperatures. There is considerable interest in available K_{Ic} data by metallurgists and materials engineers who may be concerned with comparing test data, making fracture toughness tests, or selecting materials to meet certain toughness requirements. Also, structures engineers and designers find this data useful in design. This document provides the first compilation of available K_{Ic} data. The alloys and alloy groups covered include aluminum alloys, high-strength alloy steels, intermediate- and low-strength steels, precipitation-hardening stainless steels, titanium alloys, nickel-base Alloy 718, and beryllium.

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ENHANCEMENT OF FRACTURE TOUGHNESS IN HIGH STRENGTH STEEL BY MICROSTRUCTURAL CONTROL

University of California (Berkeley), Department of Metal Sciences and Engineering. E. R. Parker, and V. F. Zackay. April 1972. 47 pages.

LBL–832

The intrinsic fracture toughness of a complex alloy is a macroscopic measure of the integrated effects of micro and macro factors which contribute to the fracture toughness. These include chemical composition, crystal structure, defect structure, and microstructure. By applying the principles of materials science that have evolved during the past two decades, it should be possible to design new alloys with superior properties. This document provides a discussion of three examples of this newer approach to alloy design. In the first example the development of TRIP steels is summarized. By controlling a single parameter, the thermodynamic stability, metastable austenic steels having a wide variety of useful combinations of mechanical properties can be produced. Some of the interrelationships between stability, properties, processing and testing conditions are discussed. The second example shows how the fracture toughness of low allow quenched and tempered steels can be significantly improved through control of microstructure. The third example is a carbon-free iron base allow designed for use at cryogenic temperatures. The principles involved in improving properties through metallurgical control are discussed.

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THERMAL AND MECHANICAL TREATMENTS FOR NICKEL AND SOME NICKEL-BASE ALLOYS: EFFECTS ON MECHANICAL PROPERTIES

Battelle Memorial Institute, Columbus Laboratories. A. M. Hall, and V. F. Beuhring. 1972. 110 pages.

N72–29562

This state-of-the-art review deals with heat treating and working nickel and nickel-base alloys, and with the effects of these operations on the mechanical properties of the materials. The subjects covered include annealing, solution treating, stress relieving, stress equalizing, age hardening, hot working, cold working, combinations of working and heat treating, and properties of the materials at various temperatures. The equipment and procedures used in working the materials are discussed, along with the common problems that may be encountered and the precautions and corrective measures that are available.

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INFLUENCE OF ALLOYING ELEMENTS ON FRICTION AND WEAR OF COPPER

Lewis Research Center (NASA). Donald H. Buckley. September 1972. 14 pages.

N72–30427

Copper base alloys are some of the most widely used in lubrication system components. Despite this, not a great deal is known about the influence of alloy components in the copper on adhesion, friction, and wear. This report provides the results of a comparison of the effectiveness of alloying elements in reducing the friction and wear of copper. Copper binary alloys containing 10 atomic percent of aluminum, silicon, tin, or indium were examined in friction and wear experiments, both lubricated and unlubricated. The results are discussed in detail.

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55-NITINOL—THE ALLOY WITH A MEMORY: ITS PHYSICAL METALLURGY, PROPERTIES, AND APPLICATIONS

Battelle Memorial Institute. C. M. Jackson, H. J. Wagner, and R. J. Wasilewski. 1972. 91 pages.

N72–30468

A series of nickel-titanium alloys (55 Nitinol), which are unique in that they possess a shape "memory," are described in this report. Components made of these materials that are altered in their shapes by deformation under proper conditions, will return to predetermined shapes when they are heated to the proper temperature range. The shape memory, together with the force exerted and the ability of the material to do mechanical work as it returns to its predetermined shape, suggest a wide variety of industrial applications for the alloys. The report includes discussions of the physical metallurgy and the mechanical, chemical, and physical properties; procedures for melting and processing the material into useful shapes; and a summary of applications which have been suggested for these unique alloys (which range from self-actuating fasteners and thermally-activated switches to advertising novelties).

MUTUAL SUBSTITUTABILITY OF ALUMINUM AND COPPER

National Materials Advisory Board. April 1972. 203 pages.

PB–211 727

Both aluminum and copper (and their respective alloys) have unique properties which make them virtually indispensable in some applications. In other cases, each can serve satisfactorily as an alternate material to the other. The incentive to substitute is largely economic, rather than technical, usually depending on relative availability and cost. This document presents a practical procedure for determining the mutual substitutability of aluminum and copper. Consideration is given to copper-aluminum supply-demand relationships, and to the substitutability in relation to design. The mutual substitutability of the two metals in specific applications is discussed. These include electrical conductors, heat exchangers, applications requiring corrosion resistance, alloying, coatings, and structural applications.

LOWERING THE TIN CONTENT OF SECONDARY LEADED TIN-BRONZE BY REPLACEMENT WITH LEAD OR ZINC

Bureau of Mines, Rolla Metallurgy Research Center. E. R. Cole, L. W. Higley, and J. L. Holman. 1972. 16 pages.

PB–211 945

Optimum conditions for producing leaded tin-bronze castings include the use of sufficient tin to produce high strength, adequate frictional properties, and corrosion resistance; and the addition of sufficient lead to yield high pressure tightness and good machinability. Standard leaded tin-bronze currently has a nominal composition of 80 wt.% copper, 10 wt.% tin, and 10 wt.% lead. This report describes a program in which leaded tin-bronze castings were produced in which the tin content was lowered to 8 wt.% and 5 wt.%, respectively, and in which the reduction in tin was offset by increasing the lead content or adding zinc. The mechanical and physical properties of the resultant alloys were then evaluated. It was found that an 80 wt.% copper, 8 wt.% tin, 10 wt.% lead, 2 wt.% zinc alloy could be had with essentially the same properties as the standard alloy. The substitution of this low-tin alloy could significantly aid in the conservation of tin.

REDUCING SURFACE HOT SHORTNESS OF COPPER BEARING STEELS

Bureau of Mines, Albany Metallurgy Research Center. Mark I. Copeland, and John E. Kelley. September 1972. 25 pages.

PB–212 660

Copper-containing steels can exhibit surface hot-shortness, with resultant cracking, when such steels are heated and hot worked. It has now been found that the use of controlled steel silicon content or the application of borax coatings show promise in preventing molten copper from forming on the surface of steels containing up to 1% Cu when these steels are heated to 1,300° C, a common temperature for rolling. By preventing copper formation during heating, surface hot shortness of the steel during rolling can be inhibited. This report describes the metallographic studies and evaluations which resulted in these findings.

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Miscellaneous Materials

DIELECTRIC CONSTANT AND LOSS DATA

Massachusetts Institute of Technology, Laboratory for Insulation Research. April 1972. 243 pages.

AD–746 686

This document is comprised of an extensive series of tables and charts depicting the dielectric parameters of a large variety of materials. The types of materials covered include inorganic compounds (largely ceramics and glasses), minerals, rocks, soils, organic compounds (including plastics), liquids, and certain foodstuffs. An index is included.

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DEVELOPMENT OF A PHOSPHATE-FREE ALKALINE CLEANER/PAINT STRIPPER

Aberdeen Research and Development Center, Coating and Chemical Laboratory. Troy R. Nichols. July 1972. 21 pages.

AD–748 803

Special powdered detergent compounds dissolved in water solutions are often utilized for paint cleaning and stripping operations during manufacture, overhaul, or rebuilding of materials. They are preferred over solvent types because they are easy to handle, relatively non-toxic, non-flammable, and can normally be disposed of by standard waste discharges. In recent years concern has been expressed about the contents of water discharges from areas using these compounds. One of the major concerns has been with the phosphates in such compounds because of their relationship with eutrophication of streams and waterways. This report describes the development of a phosphate-free composition which can be used either as an alkaline paint remover or as an alkaline cleaner depending upon concentration. The new composition is equal to or superior to older formulations.

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EMERGING AEROSPACE MATERIALS AND FABRICATION TECHNIQUES

Air Force Materials Laboratory. Albert Olevitch (Editor). January 1969. 170 pages.

AD–849 740

The aerospace industry has evolved a large number of new materials and manufacturing methods to meet its special needs. Many of these have a potential for application in other industries. This document provides a resume of some of the most promising of the materials and processes which were developed during the 1960's. A brief description is given of each material or process and a summary of the important physical and mechanical properties are presented. In addition, limitations or disadvantages are indicated where applicable. Suggested applications are also given, but in many instances it is expected that the properties of these materials will suggest other useful applications. The general types of materials covered include metals and alloys, seals and sealants, coatings and finishes, fibers and filaments, plastics, adhesives, ablation materials, graphites, ceramics, hydraulic fluids, lubricants, and electronic materials.

Plastics and
Elastomers

EFFECT OF BUBBLE INCLUSIONS ON THE MECHANICAL PROPERTIES OF CAST POLYMETHYL METHACRYLATE

Naval Undersea Center. J. D. Stachiw. August 1972. 16 pages.

AD–746 862

Although the mechanical properties of acrylic plastic are well known, very little is known about its structural behavior when bubbles are present in it. Such bubbles are usually generated during casting or subsequent curing. An evaluation of 120 specimens of acrylic plastic machined from castings with bubble inclusions is described in this report. It was found that such bubbles significantly reduce the ability of such castings to carry tensile stress. Bubble inclusions were found not to affect the compressive yield strength of acrylic plastic; they do, however, act as fracture sources when the plastic uniaxially compressed more than 5 percent. Recommendations are provided for design adjustments to be made when working with bubble-containing acrylic plastics.

CARBON BLACK AS A HEAT STABILIZER IN SILICONE RUBBER VULCANIZATES

Army Weapons Command, Research, Development and Engineering Directorate. John A. Williams. April 1972. 22 pages.

AD–747 769

Silicone rubber is considered to be one of the most heat-resistant elastomers available. Vulcanizates of silicone rubber are capable of retaining upward to 75% of their tensile strength at 300°F. Without the addition of a heat stabilizer, however, silicone vulcanizates lose their elastomeric properties in fewer than three days at 600°F. The most commonly used heat stabilizer is ferric oxide. It has now been found that the usually less expensive carbon black has the capacity to improve the heat-aging resistance of silicone rubber, and in some cases, is superior in this capacity to ferric oxide. This report describes the investigation that led to these findings, and provides data on the various successful formulations and their characteristics. Possible applications for silicone rubber stabilized with carbon black include seals for hot engine oils and hydraulic fluids, seals in equipment exposed to hot exhaust gases, push-rod covers, spark plug boots, carburetor check valves, and hose for use in diesel engines.

TERMITE RESISTANCE OF POLYVINYL CHLORIDE PLASTICS IN SOUTHERN TEMPERATE AND TROPICAL ENVIRONMENTS. FINAL REPORT OF PHASE I—EFFECT OF PLASTICIZERS AND INSECTICIDES

Navy Research Laboratory. J. D. Bultman, C. R. Southwell, and Raymond H. Beal. June 1972. 22 pages.

AD–748 589

Damage to man's goods by the activity of termites has long been a problem in those regions where these animals abound. Some of this damage is inflicted on polymeric insulating materials used on communication lines and in electronic equipment. Consequently, a program has been undertaken to investigate the nature of termite attack on such polymeric materials and to evaluate the performance of experimental formulations. The phase of the program which is the subject of this report involved experimental polyvinyl chloride plastics in combination with various plasticizers and toxicants. The data presented represent the cumulative results of termite attack on specimens of these plastics exposed as long as 75 months in the Panamanian jungle and as long as 60 months in the pine woods of Mississippi. The plasticizers involved were dioctyl phthalate, dioctyl adipate, and tricresyl phosphate; the toxicants were the insecticides aldrin, dieldrin, and lindane. A total of 32 combinations were investigated.

TERMITE RESISTANCE OF POLYMERIC MATERIALS. PHASE 2—NONTOXIC POLYMERS

Naval Research Laboratory. C. R. Southwell, J. D. Bultman, and R. H. Beal. July 1972. 24 pages.

AD–747 589

It is generally recognized that most woods used in construction are susceptible to termite attack, and adequate protective treatments and barriers are usually employed. The necessity and possibilities for protective procedures have not yet been established for the newer polymeric materials, however. In order to partially rectify this situation, exposure tests were made with polymer specimens of various precisely known compositions in termite-hazardous locations at two temperate and two tropical sites. A total of 1350 specimens were exposed for periods of 3 to 3½ years. The results and conclusions drawn therefrom are presented in this report. Most of the formulations tested were based on polyvinyl chloride. Among these, several physical modifications (surface smoothness, thickness, hardness, incorporation of mineral fillers, etc.) provided moderate to considerable improvements in resistance to attack. Highest overall performance for flexible materials was obtained with ethylene propylene rubber and chlorosulfonated polyethylene formulations. These were about equal in effectiveness to the best toxic formulations reported in AD-748 589, and offer the additional advantages of being innocuous to man and having the promise of very long service life without loss of effectiveness.

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SOLID-PHASE FORMING (COLD FORMING) OF PLASTICS

Plastics Technical Evaluation Center. Joan B. Titus. January 1972. 104 pages.

AD–752 136

The conventional way to form thermoplastics is by shaping viscous molten polymer under pressure in a cold mold. Such processes have inhibited the utilization of plastic parts to some extent due to high production costs, expensive and time consuming mold manufacturing, slow production rates due to the cooling steps, inability to meet some part design requirements, and limited use of high molecular weight, high density materials due to processing difficulties. During the past few years, much effort has been devoted to the use of well-established metalworking techniques as a method of converting thermoplastic materials into finished parts. Two general types of process are generally recognized: (1) Cold forming, which is performed at room temperature with unheated materials and tools; and (2) Solid-phase forming, in which the material is heated below its melt temperature and formed while in a heated solid phase. Specific processes include: Forging (closed die forming, cold heading, extrusion); sheet forming (stamping, rubber pad forming, diaphragm forming, coining, brake press bending, roll forming, explosive forming, spinning); and drawing and deep drawing. This report provides an in-depth state-of-the-art review of these processes. In addition to the processes themselves, attention is given to a comparison of materials suitable to these methods, part design, advantages and disadvantages of the processes, equipment and tooling requirements, processing effects on part properties, production economics, and suggested applications suitable to these techniques.

APPLICATION OF PHOTOCHROMIC AND THERMOCHROMIC COMPOUNDS FOR MONITORING CURE PROCESS IN RESIN MATRIX SYSTEMS

Air Force Materials Laboratory, Materials Engineering Branch. Sidney Allinkov. September 1968. 31 pages.

AD–842 721

The feasibility of using a color index system consisting of a photochromic, thermochromic compound incorporated in a resin matrix to show progress of the cure cycle has been demonstrated. Changes in peak absorption or optical densities signal the various stages in the cure cycle. Changes, loss, or appearance of color and color gradients can also be utilized to monitor the accuracy of processing equipment, and for determination of defective materials or improper amounts of ingredients in a formulation. The materials with which the demonstration was made were a heat-cured epoxy system and an asbestos-filled phenolic compound; the photochromic, thermochromic compound was commercially-available spiropyran. Filled plastic compounds or resins that are naturally dark can be monitored during the cure process cycle by incorporating a fluorescent type of dye. Utilization of the photochromic, thermochromic properties of the incorporated dyes may lead to a nondestructive inspection technique for detection of certain defects in plastic composites, sandwich constructions, and metal-to-metal bonds.

STUDIES OF FOAMED EPOXIES

Union Carbide Corporation. G. F. Dorsey, W. L. Harper, E. A. Larsen, and M. K. Morrow. September 1972. 87 pages.

Y–1833

Modern structural requirements have placed a considerable demand on the technology for developing many exotic polymeric materials. Foamed polymeric materials are an integral part of this "plastics revolution," and among the large number of types are the epoxy foams. An important special application of epoxy foams is that of an adhesive. Their advantages include very high bond strengths, relatively low cost due to the low spread (weight per area) of adhesive, better coverage, ease of control of spread, less wastes, and the possibility of bonding extremely porous materials. The main problem with these adhesives is the regulation of the foam stability. This report describes work on the development of reliable and stable epoxy foam adhesives. Investigation of a large number of organic compounds indicated that the long-chain carboxylic acids yield the most stable epoxy-polyamide foams and that the amines yielded the lowest density foams. The chemistry of foam materials is reviewed, and descriptions are given of stability studies and of the preparation and properties of successful compositions.

Wood

FEASIBILITY OF PRODUCING A HIGH-YIELD STRUCTURAL PRODUCT: GENERAL SUMMARY

Department of Agriculture, Forest Products Laboratory. E. L. Schaffer, R. W. Jokerst, R. C. Moody, C. C. Peters, J. L. Tschernitz, and J. J. Zahn. 1972. 23 pages.

AD–747 996

FEASIBILITY OF PRODUCING A HIGH-YIELD STRUCTURAL PRODUCT: RESIDUAL HEAT OF DRYING ACCELERATES ADHESIVES CURE

Department of Agriculture, Forest Products Laboratory. R. W. Jokerst. 1972. 14 pages.

AD–747 994

FEASIBILITY OF PRODUCING A HIGH-YIELD STRUCTURAL PRODUCT: STRENGTH PROPERTIES OF ROTARY KNIFE-CUT LAMINATED SOUTHERN PINE

Department of Agriculture, Forest Products Laboratory. R. C. Moody, and C. C. Peters. 1972. 16 pages.

AD–747 995

The production of a structural wood product by an innovative system which markedly improves yield at competitive costs has been found to be technically feasible. This "press-lam" processing system of rotary cutting thick veneer, press drying, and laminating into sheets promises an average 50% improvement in dry product yield over that normally obtained by sawing similar 12- to 18-inch diameter logs. Total processing time from log to product is less than 30 minutes, with speed of production controlled primarily by the press drying of the veneer. An economic analysis indicates the selling price to be about equal to that of the majority of sawed structural lumber used for housing. AD-747 996 provides a general review of the press-lam system, with emphasis on the nature of the product, feasibility indicators (yield, structural performance), processing costs, and specific processing effects. AD-747 994 deals in more detail with the laminating portion of the process, which is unique in that the residual heat of the drying operation is used to accelerate adhesive cure. AD-747 995 concerns the effect of manufacturing technique on selected strength properties of the product.

A COMPUTERIZED WOOD ENGINEERING SYSTEM

Department of Agriculture, Forest Products Laboratory. Stanley K. Suddarth. 1972. 54 pages.

AD–748 049

A guide is provided for using a computerized matrix system for plane wood structures. The Fortran program listing included in the document can easily be modified to run on any one of a number of digital computers. With this system, an unlimited number of types of plane frames, arches, trusses, continuous beams, etc., can be analyzed and checked against certain built-in design considerations. The user is provided with unprecedented freedom to create a mathematical model to simulate the mechanical action of a real structure. The computer accepts an input description of the analog and automatically performs an analysis regardless of the degree of complexity; it provides useful strength and deflection data in output tables.

MECHANICAL, INDUSTRIAL, CIVIL AND MARINE ENGINEERING

TESTING AND FABRICATION OF WIRE-BOND ELECTRICAL CONNECTIONS—A COMPREHENSIVE SURVEY

National Bureau of Standards, Institute for Applied Technology. Harry A. Schafft. September 1972. 140 pages.

AD–748 788

Although such methods as spider bonding, beam leads, and other face-down schemes are sometimes used for electrically connecting semiconductor dice and package terminals in integrated circuits, hybrid circuits, and low-power discrete semiconductor devices, the use of wire remains the predominant way. A detailed survey is provided of the fabrication and testing of wire-bond connections, the bonding either by thermocompressive or ultrasonic means. Processes, procedures, and materials are discussed with emphasis on reliability. The interaction of gold and aluminum is reviewed as a primary bond failure mechanism. Old and new test methods covered include visual inspection, pull, shear, air blast, push, ultrasonic stress, shock and vibration, thermal properties, electrical properties, noise, and bond monitoring. Test stress analysis is included.

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THE ROLL DIFFUSION BONDING OF STRUCTURAL SHAPES AND PANELS

Battelle Memorial Institute, Defense Metals Information Center. J. A. Houck, and E. S. Bartlett. October 1967. 44 pages.

AD–832 003

Solid-state diffusion bonding has been receiving increased attention as a technique for joining materials to produce lightweight configurations. The diffusion bonding process is particularly attractive because the mechanical and metallurgical properties of a complete diffusion-bonded joint are comparable to those of the base metal; thus, joint efficiencies close to 100% are possible. In the form of the process known as "roll diffusion bonding," the diffusion-bonded joint between structural details is formed by gross plastic flow during hot rolling. This report summarizes the state-of-the-art of the roll-diffusion-bonding process as applied to the manufacture of structural panels and shapes. In addition to a review of the elements of the process and representative mechanical properties of its products, ten specific development programs are discussed in some detail.

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MOVING ELECTRON BEAM WELDING SYSTEM

Sciaky Bros., Inc. Carlis Johnson. May 1969. 198 pages.

AD–856 191

Electron beam welding of large structures has many advantages over welding by other methods. These advantages arise from the small physical size and metallurgical purity of the electron beam weld and the high welding speed at which it can be produced. However, the requirement for enclosing the entire workpiece in a vacuum chamber has limited the maximum size of structure which can be economically welded by the electron beam process. A portable electron beam welding system has now been developed which, by utilizing a sliding seal, is capable of making a weld joint with mechanical properties comparable to fully enclosed vacuum chamber electron beam welding equipment. The equipment is capable of penetrating relatively thick square butt joints with a good bead depth to width ratio. This document describes the design of the system, and the results of a test and evaluation program.

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WELDING AND BRAZING OF NICKEL AND NICKEL-BASE ALLOYS

Battelle Memorial Institute, Columbus Laboratories. J. E. Mortland, R. M. Evans, and R. E. Monroe. 1972. 89 pages.

N72–30466

This report is a summary of available information on the joining of nickel and of alloys containing at least 50% nickel. Considerations that are applicable to all nickel alloys or to large groups of nickel alloys are first described. The discussion includes information on product materials, joint design, preweld and postweld cleaning, welding fixtures and tooling, and other preweld considerations. Consideration is then given to individual joining processes (fusion welding, solid-state welding, brazing, soldering), the joining of dissimilar metals, and special considerations to be taken when joining the various alloys. Finally, inspection techniques, defects, and repair procedures are reviewed. A bibliography of 142 items is included.

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Building Technology

DESIGN LOADS FOR INSERTS EMBEDDED IN CONCRETE

National Bureau of Standards, Building Research Division. T. W. Reichard, E. F. Carpenter, and E. J. Leyendecker. May 1972. 30 pages.

COM–72–50675

One method of holding down the construction costs of buildings is to suspend from the ceiling equipment which would otherwise occupy premium floor space. An increasing number of devices for suspending such loads are being used in industrial, institutional, and commercial buildings. A device being used with concrete slab construction is an anchor commonly called a concrete insert. These inserts are made to receive either an ordinary threaded rod, a bolt head, or a special nut. They are simply fastened to the framework prior to placing the concrete. This report presents the results of a comprehensive study of the variables influencing the ultimate load carrying capacity of some commonly used inserts. The variables included were: Insert type, concrete aggregate type, concrete strength, reinforcement cover, reinforcement spacing, angular load effect, flexural cracking effect, sustained load, and fatigue load. As a result of the investigation, design criteria are proposed for inserts embedded in reinforced concrete slabs.

THE TRANSITION TO SYSTEMS ARCHITECTURE

M. N. Crabtree Associates, Inc. Joseph F. Pierz. Jan. 1972. 13 pages.

PB–210 328

A report is made on an effort to create a flexible technique for the effective software services and hardware components in building and the construction industry, by means of a proposed organization designated as Omniform Inc. The organization would be expected to offer environmental planning, test facilities for hardware, and a computerized data center. Some of the operations desired would be finance and corporate development, software for investments, planning, management, supervision, consulting, and documentation; hardware for scheduling, cost control, structural and plant engineering, and utilities. A client user system would consist of a team coordinator and a construction manager. Problems to be solved include antiquated codes, segregated markets, union practices, and the attitudes of professional and nonprofessional associations.

MASS PRODUCTION URBAN HOUSING

California State Polytechnic College, School of Architecture. David R. Saveker, and J. Handel Evans. May 1969. 74 pages.

PB–212 611

With the rise in world population and improvements in technology there is an ever expanding market for better housing. A new general structural system is described in this report which is aimed towards fast and economical field erection of housing units. The principal elements of the system for immediate or architectural application are modular units for floors (or decking), walls, and girder (or column) supporting elements. The structural system is amenable to factory production using relatively unskilled factory labor. Dimensional reproducibility is achieved through die forming the various elements—either in punching or explosive form-

Building Technology (continued)

ing operations. The configuration permits prefabricated installation of the plumbing and electrical elements prior to field erection, so that major labor savings are achieved on the site. (For a method for explosive forming utility conduits for this system, see PB-212 612 in the Manufacturing Methods section of this issue.) A cost study is also provided, based on a seven story apartment building containing 56 dwelling units.

Civil Engineering

DEVELOPMENT OF DESIGN CRITERIA AND ACCEPTANCE SPECIFICATIONS FOR PLASTIC FILTER CLOTHS

U.S. Army Engineer Waterways Experiment Station. C. C. Calhoun, Jr. June 1972. 105 pages.

AD–745 085

The technology of preventing the hydraulic erosion of shores, stream and river bottoms, and soil around pipes and well screens, as well as in other situations, includes the laying of filter cloths at vulnerable sites. Such cloths have been used beneath riprap, rubble, or articulated revetments, and as substitutes for granular layers. Laboratory and field investigations are reported for the development of design criteria and acceptance specifications for filter cloths of propylene, vinylidene chloride, and ethylene plastics, and the results of tests for deterioration are presented. Criteria are outlined for various soil types; recommendations are made for strength and abrasion resistance; and laboratory investigations are described for determining weaving and openings to prevent clogging.

EFFECT OF RESERVOIR FILLING ON STRESSES AND MOVEMENTS IN EARTH AND ROCKFILL DAMS

University of California (Berkeley), College of Engineering. E. S. Nobari, and J. M. Duncan. January 1972. 184 pages.

AD–745 216

This report concerns the development of analytical procedures which may be used to analyze the effects of reservoir filling on the stresses and movements in earth and rockfill dams. The procedures employ incremental finite element analysis, together with nonlinear stress-strain characteristics determined by means of laboratory tests. The method takes account of the water pressure loads on the core and the dam foundation, the buoyant uplift forces and seepage forces in the wetted portion of the dam, and the compression due to wetting. The report also contains a review of published case histories of the behavior of earth and rockfill dams during reservoir filling, and the results of an experimental investigation of the effects of water on the properties of granular materials.

SYMPOSIUM ON CHANNEL STABILIZATION PROBLEMS. VOLUME 1.

Army Corps of Engineers, Committee on Channel Stabilization. September 1963. 112 pages.

AD–746 961

SYMPOSIUM ON CHANNEL STABILIZATION PROBLEMS. VOLUME 2.

Army Corps of Engineers, Committee on Channel Stabilization. May 1964. 252 pages.

AD–746 964

SYMPOSIUM ON CHANNEL STABILIZATION PROBLEMS. VOLUME 3.

Army Corps of Engineers, Committee on Channel Stabilization. June 1965. 130 pages.

AD–746 965

SYMPOSIUM ON CHANNEL STABILIZATION PROBLEMS. VOLUME 4.

Army Corps of Engineers, Committee on Channel Stabilization. February 1966. 200 pages.

AD–746 966

The bed and banks of any stream are unstable in greater or less degree depending upon its geological environment, discharge, and slope. The purpose of stabilization is to so control the flow that a favorable channel shall form in places where it has been inadequate. Re-forming the channel often alters the natural tendencies and creates new problems. These volumes are comprised of papers which were presented at a series of symposia held at various times during the years 1962 through 1964. A number of the papers deal with general aspects of channel stabilization, i.e., river control structures, regulation and contraction works, hydraulic models, and similar topics. Most of the papers, however, are case studies of the design and construction of actual works on alluvial rivers.

A PROCEDURE FOR COMPUTATION OF THE TOTAL RIVER SAND DISCHARGE AND DETAILED DISTRIBUTION, BED TO SURFACE

Army Corps of Engineers, Committee on Channel Stabilization.
F. B. Toffaleti. November 1968. 187 pages.

AD–746 970

In the design of multipurpose, flood-control, navigation, channel rectification, and miscellaneous hydraulic structures, a problem of sedimentation is frequently posed. In order to determine the extent to which this may be detrimental to project efficiency, or to judge remedial measures of allowances that must be made, it is of immediate interest to have some knowledge as to the rate or magnitude of occurrence of sedimentation. This report presents a practical and reasonably accurate mathematical procedure for the resolution of these questions. It includes a step-by-step procedure for performing calculations, tabular and graphic comparisons of computed and measured sand discharges, the results of special investigations made to demonstrate the versatility of the proposed procedure, and a detailed development of the procedure. Also given is a program listing for a computer program capable of performing the calculations.

STATE OF KNOWLEDGE OF CHANNEL STABILIZATION IN MAJOR ALLUVIAL RIVERS

Army Corps of Engineers, Committee on Channel Stabilization.
G. B. Fenwick (Editor). October 1969. 266 pages.

AD–746 972

This document is intended to acquaint engineers with the many facets of the complex problems involved in improving and stabilizing the channels of major alluvial rivers, and with the various approaches to solving these problems. It is, in essence, an assessment of the contemporary state of knowledge in this area. The subjects covered include: Geomorphology of alluvial rivers; channel geometry; sedimentation; hydraulics; fluvial hydraulic models; determination of soil and ground-water conditions; instrumentation and field surveys; channel improvement and stabilization measures.

TUNNEL-SITE SELECTION BY REMOTE SENSING TECHNIQUES

University of Michigan, Willow Run Laboratories. Thomas Wagner, Robert Vincent, Ben Drake, Ralph Mitchel, and Philip Jackson. September 1972. 101 pages.

AD–748 663

Research is being conducted on an airborne geologic reconnaissance system capable of producing surface and subsurface geologic maps which can be used to predict subsurface conditions in possible tunneling sites. The system would simultaneously utilize aerial photography, synthetic aperture radar, and multispectral scanning, with ground-truth investigations to verify the remote sensing data. An investigation is reported of the role of remote sensing in this field, in which data from the sensors were processed and evaluated on indications of silicon dioxide and iron oxide in the terrain. It is expected that the report can be used in data processing technology and instrumentation development. A review of the literature is given; the multispectral scanning concept and system are discussed; rock outcrop imagery is outlined; and applications of sidelooking radar are noted. Recommendations are made for further research.

RIPRAP STABILITY ON EARTH EMBANKMENTS TESTED IN LARGE- AND SMALL-SCALE WAVE TANKS

U.S. Army Corps of Engineers, Coastal Engineering Research Center. Arvid L. Thomsen, Paul E. Wohlt, and Alfred S. Harrison. June 1972. 128 pages.

AD–748 414

A study has been undertaken to provide information for the design of riprap protection for new construction and for the improvement of existing riprap overlays. Tests were made in wave tanks of models ranging from about 1:20 scale to almost full scale and with waves up to about 6 feet high. Relationships that define the effect of wave height, wave period, embankment slopes, and Reynolds number on the size of stable riprap armor units of several types were experimentally determined; the results are presented in a series of graphs and tables. Although the work was aimed primarily at protection for earth dams and embankments in reservoirs, it applies also to riprap seawalls and other coastal protection.

INSPECTION OF PILE DRIVING OPERATIONS

Construction Engineering Research Laboratory. M. T. Davisson. July 1972. 62 pages.

AD–749 458

This manual describes the information that should be accumulated during the inspection of pile driving operations. The inspection techniques described are concerned primarily with technical items, but methods of incorporating information on pay items are also described. The manual begins by explaining pre-construction organization, then the pile driving operation, and finally the data that the inspector must record. Two appendices include additional technical information on pile drivers of both the hammer and vibratory types.

SEISMIC DETERMINATION OF GEOLOGICAL DISCONTINUITIES AHEAD OF RAPID EXCAVATION

Bendix Research Laboratories. R. R. Gupta. September 1972. 88 pages.

AD–749 977

A method of probing the geological medium ahead of continuous excavation machines, in real-time, is essential in order to avoid, or to be prepared for, hazardous or difficult formations. Knowledge of potential hazards will result in increased safety for both men and equipment, and will allow excavation to proceed at maximum speed. An acoustic pulse-reflection method has now been found to be feasible for this purpose. Equipment was developed which permits the detection of a fault or fracture zone in hard rock; also, discontinuities as far away as 30 feet can be identified using cross-correlation techniques for signal processing. The design of the equipment is described, and results are given of laboratory and field investigations. Recommendations are made for further optimization of the system.

DYNAMIC RESPONSE OF REINFORCED OPENINGS IN ROCK

North Central Army Engineer Division. Lewis H. Blakey. 1972. 15 pages.

AD–750 309

The rapid development of the finite element method within the field of structural mechanics has been an achievement of the first rank. Many problems hitherto intractable can readily be solved to any required degree of accuracy by means of this method. This document reports the development of a solution, using the finite element method, to the problem of the dynamic response of circular openings in rock subjected to ground motion resulting from earthquakes or other disturbances of the underground environment. It discusses the application of the finite element method, the numerical solution of the equations of motion, and problems in the application of the solution.

INDUCED TRENCH METHOD OF CULVERT INSTALLATION

State of Illinois, Division of Highways. R. K. Taylor. November 1971. 55 pages.

PB–212 053

The relatively flat profiles of modern high-speed highways result in high earth fills which require longer culverts capable of supporting heavier overburden loads. One proposed method of reducing culvert costs under such conditions is the induced trench procedure, formerly known as the imperfect trench method. Essentially, the procedure involves: thoroughly compacting the soil around and above the pipe to a height of about one pipe diameter; constructing a trench directly over the culvert by removing a prism of material from the compacted fill; refilling the trench with a loose compressible material; and completing remainder of the embankment in the usual manner. This type of construction results in large load reductions on the culvert. This report gives the results of an evaluation of the settlement ratio and compares the measured loads acting on the culvert with theoretical loads. The data obtained is useful for establishing design criteria for this type of construction.

Communication Technology

SATELLITE TELEVISION FOR INDIA: TECHNO-ECONOMIC FACTORS

Massachusetts Institute of Technology. R. C. Butman. September 1972. 61 pages.

PB–213 226

This report examines some of the techno-economic aspects of the use of satellites for education and instruction in lesser developed countries. In particular, it considers the available trade-offs between satellite and terrestrial television networks. The major concern is the proposed Indian satellite system, but the general discussions of equipment costs are equally valid for other less developed countries. Some of the topics covered include: The objectives of a nationwide television network in India; general system principles which bear on the selection of a television/communications system; terrestrial broadcast transmitter equipment and coverage costs; pertinent characteristics of satellites in use or proposed for use in less developed countries for television distribution; television receivers for use in small villages; relay and telecommunications considerations; comparative costs of satellite and terrestrial systems.

Environmental Technology

INDUSTRIAL PROCESS POLLUTION. A SAFETY ASSESSMENT OF AIR POLLUTANTS FOR THE SAFETY ENGINEER

Texas A and M University, Industrial Engineering Department. Roy W. Lee. 1971. 78 pages.

AD–747 675

Until recently, the main source of air pollution was considered to be from the burning of mineral fuels in domestic furnaces, industry, power stations, and automobile engines. However, it is now realized that emissions from industries involving the processing of chemicals also contribute significantly to the pollution of the ambient air. This document provides a technical guide to assist the safety engineer in assessing the hazards and related safety problems that result from potential and actual sources of air pollutants emitted from industrial processes. The topics covered include: A historical survey of air pollution control efforts; basic techniques for isolating and identifying hazardous pollutants; the effects of air pollutants on human health and safety; current air pollution control technology; laws and legislation relevant to air pollution control; and an annotated survey of information sources pertinent to the control of air pollution.

AN ANNOTATED BIBLIOGRAPHY ON WEATHER MODIFICATION, 1960-1969

National Oceanic and Atmospheric Administration, Environmental Science Information Center. Annie E. Grimes. June 1972. 416 pages.

COM–72–11287

This bibliography is comprised of abstracts of 858 publications concerning weather modification which appeared in the World's literature during the period 1960–1969. The subject areas covered include evaluation and potentialities of cloud seeding operations, cloud seeding theories and experiments, legal aspects of weather modification, economic implications, hail control, lightening suppression, cloud and fog dissipation, nuclear explosion effects, hurricane control, and large-scale climate modification. Subject and author indexes are included.

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CONSTRUCTION DETAILS OF ISOKINETIC SOURCE-SAMPLING EQUIPMENT

Environmental Protection Agency, Air Pollution Control Office. Robert M. Martin. April 1971. 35 pages.

PB–203 060

MAINTENANCE, CALIBRATION, AND OPERATION OF ISOKINETIC SOURCE-SAMPLING EQUIPMENT

Environmental Protection Agency, Office of Air Programs. Jerome J. Rom. March 1972. 39 pages.

PB–209 022

Isokinetic source-sampling equipment has been in use since 1967 for the purpose of sampling the content of industrial stack gases. PB-203 060 was prepared for the purpose of providing those wishing to construct their own equipment with detailed instructions. PB-209 022 is a guide to the maintenance, calibration, and operation of the equipment.

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THE RELATIONSHIP BETWEEN LAND USE AND ENVIRONMENTAL PROTECTION

Argonne National Laboratory. E. J. Croke, K. G. Croke, A. S. Kennedy, and L. J. Hoover. May 1972. 56 pages.

PB–209 642

The report concerns the effect of past and present land use control decisions on environmental quality; standards and tools for evaluating environmental impact; and the need for legislation to support environmental protection. It indicates some of the legal, institutional, organizational, and technical aspects of the regulatory approach to the preservation of environmental quality. Procedures and practices of public and other groups in developing programs and policies are discussed. Liaisons are recommended between responsible agencies at the federal, state, and local levels. A case is presented for integrating all such land use planning and regulation measures for environmental protection.

PAINT TECHNOLOGY AND AIR POLLUTION: A SURVEY AND ECONOMIC ASSESSMENT

Environmental Protection Agency, Office of Air Programs. J. W. Spence and F. H. Haynie. February 1972. 49 pages.

PB–210 736

With the growing use of reinforced plastics, stainless steel, and laminated wood, requiring little or no painting, as structural materials, the paint industry is experiencing sales decreases. In order to compete, the industry is developing thinner finishes with improved durability and reduced air polluting characteristics. The report surveys technical developments with regard to paint resistance to airborne paint-damaging substances such as hydrogen sulfide, sulfur dioxide, and ozone. An economic assessment is given of the chemical damage of gaseous and particulate air pollutants on four classes of exterior paints. Considerable attention is paid to the development of tests for weatherability, and to the chemical actions involved in paint deterioration.

ACCIDENTAL EPISODE MANUAL

Resources Research, Inc. Frederic C. Hamburg, Edward J. Largent, and Alfred T. Barnard. January 1972. 259 pages.

PB–210 814

An accidental air pollution episode may be defined as an unexpected event during which contaminants are released into the air in amounts that are potentially hazardous to public health and welfare. It usually occurs when a relatively massive quantity of contaminants is released into the air and transported over inhabited areas. This manual provides guidelines concerning what can or ought to be done during an event to help minimize its impact upon the people and economic life of a community. It is intended primarily for public safety officials and air pollution control organizations, but it should also be useful to industries where hazardous materials are handled or produced. Topics include: Air pollution control organization contingency action; air pollution chemical detection techniques; hazard area estimates; contingency plan for community action; contingency plan implementation; communications; case histories and statistics on accidental episodes.

AIR POLLUTION ASPECTS OF EMISSION SOURCES: IRON AND STEEL MILLS. A BIBLIOGRAPHY WITH ABSTRACTS

Environmental Protection Agency, Air Pollution Technical Information Center. May 1972. 86 pages.

PB–211 435

This bibliography contains about 300 abstracts of publications dealing with air pollution aspects of iron and steel mills. The abstracts are arranged according to the following categories: Emission sources, control methods, measurement methods, air quality measurements, basic science and technology, effects on human health, effects on materials, economic effects, standards and criteria, legal and administrative aspects, and social aspects. Subject and author indexes are included.

SANITARY LANDFILLS: A BIBLIOGRAPHY

Water Resources Scientific Information Center. George L. Knapp (Editor). July 1972. 169 pages.

PB–211 565

This bibliography contains abstracts of 120 published articles and reports dealing with sanitary landfills. Emphasis is on the possible effects of landfills on natural waters. Subject and author indexes are included.

TERRESTRIAL AND FRESHWATER RADIOECOLOGY. A SELECTED BIBLIOGRAPHY

U.S. Atomic Energy Commission, Technical Information Center; and Washington State University. Alfred W. Klement, Jr., and Vincent Schultz. 1972. 151 pages.

TID–3910–SUP–8

This bibliography is comprised of over 1700 references to the world's literature concerning the involvement of radionuclides in terrestrial, freshwater, and brackish-water ecosystems. Most of the publications referred to were published in the period 1969–1971.

SYSTEMS ENGINEERING APPLIED TO THE ANALYSIS OF CONTINUING FLOW CONVEYORS

University of Florida, Systems Research Center. Eginhard J. Muth. April 1972. 34 pages.

AD–744 529

The closed loop conveyor, one of the links in modern manufacturing processes, has a double utility—besides its function of transporting materials it can also store them. The conveyor, being an element of a larger system, should transform input flows into output flows as dictated by the system. Two questions have arisen: What transformations are feasible in terms of input output functions, and how can these functions be put into criteria for design and operation. A mathematical treatment of the time and space characteristics of material flow in such a system is presented. The paper deals with systems in which the flow is continuous, as on a belt conveyor, and is focused on analytical solutions. Discrete material flows, such as on a conveyor with buckets, and numerical solutions are not covered. A mathematical model is constructed using conveyor parameters of velocity, path length, and loading, along with operating requirements of time and cycle. Balance of flow on the conveyor is represented by a difference equation. Solutions are presented graphically for several specific cases.

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ENGINEERING DESIGN HANDBOOK. DESIGN GUIDANCE FOR PRODUCIBILITY

Army Materiel Command. August 1971. 397 pages.

AD–890 839

This handbook is intended to provide guidance to the individual designer through which he may recognize, at the earliest practical point in the design effort, those problems of production and support which, if eliminated from the design, will further the objective of creating a design which can be manufactured using readily available materials, in the shortest possible time, at the lowest cost, by the largest possible segment of the industrial base. It therefore provides a collection of pertinent information to aid in designing for ease of production, including the maintenance of required levels of quality. Topics include: Basic concepts and considerations; design evolution; systematic approach to design; planning for producibility; common deficiencies in design; specifications and standards; value engineering techniques; selection of materials and processes; material producibility objectives; fabrication processes; heat treating and cleaning processes; joining methods; coating materials and methods; the technical information environment; the design environment; the production environment.

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Industrial
Engineering
(continued)

MANAGEMENT TECHNIQUES. A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1970. 22 pages.

N71–31516

This document presents a selection of management techniques in summary form, covering a wide range of efficiency and cost-saving programs. The techniques were originally developed by or for NASA, but they all have potential for application outside the aerospace industry. Representative techniques discussed include new management and training concepts; accounting and time-use methods which update costs for any given period; computer checks on engineering and schedule effectiveness; data reduction; automated forms and control; and long range planning of manpower. Additional, more detailed, information concerning most of the techniques is available from NASA.

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GENERAL METHODOLOGY: COSTING, BUDGETING, AND TECHNIQUES FOR BENEFIT-COST AND COST-EFFECTIVENESS ANALYSIS

Lewis Research Center (NASA)
D. Michael Stretchberry, and Gerald F. Hein. August 1972. 20 pages.

N72–29979

Long range planning is important for both government agencies and private businesses. Benefit-cost analysis (which includes both benefit-cost ratio and cost-effectiveness analysis) represents a powerful tool for this planning procedure. This report summarizes the use of benefit-cost ratios cost-effectiveness analysis to evaluate programs or alternatives to do a program. It also summarizes the general methodology of costing and budgeting of programs. The general concepts that influence costing, budgeting, and benefit-cost analysis are discussed. Long-range planning concepts are also presented. Finally, specific practices and techniques are discussed and illustrated for most of the general concepts.

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Machinery and
Equipment

MOUNTAINEERING EQUIPMENT EVALUATION

Arctic Institute of North America. Joseph C. Labelle. October 1972. 69 pages.

AD–751 902

This report provides the results of a testing and evaluation program of commercially available mountaineering equipment. All of the equipment was actually use tested on various terrain and under varying climatic extremes. The types of equipment evaluated includes: Ski and snowshoe bindings; climbing boots; gaiters; tents; blankets; rope ascenders; pulleys; carabiners; pitons; snow anchors; piton hammers; crampons; climbing ropes; ice axes; insulating material; and sleeping pads. For each item, information is provided concerning price, supplier, a description of the item and its use, commendable features, shortcomings, and possible alterations or modifications which could render the item more suitable.

DEVELOPMENT OF AN INTEGRATED AND MECHANIZED HIGH ENERGY FORMING MACHINE

LTV Aerospace Corporation, Vought Aeronautics Division. R. A. Ford, W. J. Harris, Jr., and G. E. Kuhn. June 1968. 389 pages.

AD–843 998

A program was undertaken to increase the production capabilities of high energy forming beyond the present state of the art by developing a new and highly mechanized high energy forming system capable of fabricating sheet metal part shapes and materials beyond the limits of present conventional forming equipment. This was successfully accomplished by the development of a new type of machine which utilized integrated high energy forming processes in a single, closed forming system. The machine, which is rated for a static load capacity of 25,000 tons, makes it possible to perform sheet metal forming operations previously impossible due to size or pressure limitations of many types of conventional equipment. It has a capability for doing the combined work of several different machines for bending, drawing, stretching, shrinking, and bulging operations. In addition to providing details on the development, design, and operation of the machine, this report gives an evaluation of existing high energy forming processes.

DESIGN OF A PRODUCTION HYDROSTATIC EXTRUSION PRESS

Battelle Memorial Laboratory, Columbus Laboratories. G. E. Meyer, R. J. Fiorentino, and A. M. Sabroff. June 1968. 71 pages.

AD–855 308

Hydrostatic extrusion is a method of extruding a billet through a die by the action of a pressurized fluid rather than by direct contact with a ram as used in conventional extrusion. Because the billet is surrounded by liquid, billet-container friction is eliminated and billet-die friction is reduced; this permits extrusion pressures considerably less than corresponding values obtained in conventional extrusion. The system also allows the extrusion of very long billets and of irregularly shaped billets. This report describes the design of a large production hydrostatic extrusion press that was developed as a result of an extensive design study. An estimate of equipment cost and an economic analysis of the process compared to conventional techniques are also described. The conversion of existing conventional presses into hydrostatic extrusion presses seems to be technically feasible.

DYNAPAK 1-1/2 MILLION FOOT POUND FORGING MACHINE

General Dynamics Corporation, Electro Dynamics Division. M. Chanin, and J. Koskoris. September 1969. 154 pages.

AD–864 988

A program was undertaken to scale-up the size and energy potential of high velocity, controlled energy type forging machines to establish additional capacity for larger net size complex forgings. The result is a 1½ million foot pound high energy rate forging press, which is a pneumatic-mechanical type press of true counterblow design. The machine incorporates mechanical, hydraulic, and electrical systems. This document provides complete design and engineering plans for the machine.

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DIRECT NUMERICAL CONTROL OF MACHINE TOOLS

Bendix Corporation, Kansas City Division. G. L. Finlay, W. L. Saloga, and D. L. Setter. June 1972. 74 pages.

BDX–613–540 (Rev.)

Direct Numerical Control (DNC) involves the use of a computer to control a number of machine tools, as opposed to conventional numerical control in which punched or magnetic tapes are prepared for individual hard wired logic machine control units. This report provides a description of the various DNC approaches which have evolved, and discusses the reasons for each approach. A survey is also made of commercially available DNC systems. Appendices include a glossary of DNC terminology, specifications of commercial DNC systems, and a list of reference materials.

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MACHINE TOOLS AND FIXTURES—A COMPILATION

National Aeronautics and Space Administration. Technology Utilization Office. 1972. 30 pages.

N72–14495

This document provides descriptions of a selection of machine tools, jigs, and fixtures which have been produced, modified, or adapted to meet the needs of NASA, but which have a potential for application outside the aerospace industry. The first section of the document presents a variety of machine tool applications that offer easier and more efficient production techniques. The second section deals with methods, techniques, and hardware that aid in the setup, alignment and control of machines and machine tools to further quality assurance in finished products. Finally, descriptions are given of jigs, fixtures, and adapters that are ancillary to basic machine tools and aid in realizing their greatest potential. Additional detailed information is available from NASA on many of the items described. (This document contains a different selection of tools and methods from that contained in a previous report of the same title, N71-24078, described in AMTID, January 1972, page 42.)

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HOW TO APPLY LIFE ADJUSTMENT FACTORS FOR BALL AND ROLLER BEARINGS

Lewis Research Center (NASA). W. J. Crecelius, T. A. Harris, C. A. Moyer, R. J. Parker, J. J. Sherlock, and E. V. Zaretsky. May 1972. 18 pages.

N72–24527

Practical problems applicable to the selection, design, and lubrication of rolling-element bearings are presented and discussed. Design and selection criteria are based upon materials and processing factors such as melting practice, metalworking, and heat treatment. Environmental factors are considered such as bearing misalignment and speed. Selection of a lubricant is based upon elastohydrodynamic lubrication principles in addition to lubricant type and chemistry. The solution of the problems are based on the ASME Engineering Design Guide—Life Adjustment Factors for Ball and Roller Bearings.

HAND TOOLS—A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1972. 26 pages.

N72–31494

A compilation is provided of a number of new hand tools, modifications of existing tools, and techniques developed for or by NASA, and which are potentially applicable outside the aerospace industry. Two main types of tools are presented. Tools for cable and connector applications, and tools for welding applications. Safety is emphasized, together with ease of operation and use in restricted areas or hazardous environments. Further detailed technical information on many of the tools is available from NASA. (The selection of tools in this document is different from that in an earlier document of the same title, N71-23910, described in AMTID, January 1972, page 42.)

SPINDLE EVALUATION

U. S. Atomic Energy Commission, Technical Information Center.
P. J. Steger. December 1972. 16 pages.

Y–DA–4833

APPLICATIONS OF AIR BEARINGS

U. S. Atomic Energy Commission, Technical Information Center.
P. J. Steger. December 1972. 21 pages.

Y–DA–4834

HIGH-SPEED MOTION PICTURES FOR METAL-CUTTING ANALYSIS

U. S. Atomic Energy Commission, Technical Information Center.
R. L. Williams. December 1972. 15 pages.

Y–DA–4836

UPGRADING NUMERICALLY CONTROLLED MACHINE TOOLS FOR ERROR REDUCTION

U. S. Atomic Energy Commission, Technical Information Center.
S. S. Douglass. December 1972. 14 pages.

Y–DA–4837

AIR–BEARING REWORK AND IMPREGNATION

U. S. Atomic Energy Commission, Technical Information Center.
W. H. Rasnick. December 1972. 14 pages.

Y–DA–4838

AIR-BEARING LVDT (LINEAR VARIABLE DIFFERENTIAL TRANSFORMER) TRANSDUCER

U. S. Atomic Energy Commission, Technical Information Center.
W. H. Rasnick. December 1972. 7 pages.

Y–DA–4839

MICROINCH MACHINING

U. S. Atomic Energy Commission, Technical Information Center.
W. M. Warmbrod. December 1972. 22 pages.

Y–DA–4840

PART SUPPORT

U. S. Atomic Energy Commission, Technical Information Center.
W. F. Jones. December 1972. 11 pages.

Y–DA–4841

MACHINE TOOL CONTROL VIA A MINICOMPUTER

U. S. Atomic Energy Commission, Technical Information Center.
G. L. Bowers. December 1972. 9 pages.

Y–DA–4941

AN OVERVIEW OF PRECISION MACHINING AND GAGING

U. S. Atomic Energy Commission, Technical Information Center
J. M. Googin. December 1972. 8 pages.

Y–DA–4993

GAGE CALIBRATION AND CONTROL SYSTEM

U. S. Atomic Energy Commission, Technical Information Center.
R. L. Davis. December 1972. 10 pages.

Y–DJ–10783

SURVEY OF NONDESTRUCTIVE TESTING AS APPLIED TO DIMENSIONAL MEASUREMENT

U. S. Atomic Energy Commission, Technical Information Center.
J. W. Garber. December 1972. 18 pages.

Y–DL–225

SPECIALIZED GAGING EQUIPMENT

U. S. Atomic Energy Commission, Technical Information Center.
M. E. O'Hara. December 1972. 23 pages.

Y–DN–11

INSPECTION MACHINE UPGRADING

U. S. Atomic Energy Commission, Technical Information Center.
J. W. Smith. December 1972. 18 pages.

Y–DN–14

COMPUTER-CONTROLLED MACHINES FOR DIMENSIONAL INSPECTION APPLICATIONS

U. S. Atomic Energy Commission, Technical Information Center.
H. S. Schwartz. December 1972. 16 pages.

Y–DN–16

CALIBRATION OF DISPLACEMENT TRANSDUCERS

U. S. Atomic Energy Commission, Technical Information Center.
T. R. Butler. December 1972. 12 pages.

Y–DN–17

SPECIFICATIONS FOR MACHINE TOOLS AND GAGES

U. S. Atomic Energy Commission, Technical Information Center.
D. L. Foulk. December 1972. 7 pages.

Y–EC–140

SITE PREPARATION AND MACHINE INSTALLATION

U. S. Atomic Energy Commission, Technical Information Center.
B. H. Hale. December 1972. 9 pages.

Y–EC–141

ENVIRONMENTAL CONTROL FOR PRECISION MACHINING

U. S. Atomic Energy Commission, Technical Information Center.
E. E. Choat. December 1972. 16 pages.

Y–EC–142

CLEANLINESS CONTROL

U. S. Atomic Energy Commission, Technical Information Center.
J. W. Bagwell. December 1972. 10 pages.

Y–EC–143

CLEAN ELECTRICAL POWER

U. S. Atomic Energy Commission, Technical Information Center.
H. G. Smith. December 1972. 10 pages.

Y–EC–144

PART PROGRAMMING FOR NUMERICAL CONTROL MACHINING AND GAGING

U. S. Atomic Energy Commission, Technical Information Center.
P. J. Anderson. December 1972. 13 pages.

Y–EC–155

DATA COLLECTION AND CORRECTION ON A COMPUTER-CONTROLLED DIMENSIONAL INSPECTION MACHINE

U. S. Atomic Energy Commission, Technical Information Center.
T. W. Bookhart. December 1972. 11 pages.

Y–EC–156

SOME ASPECTS OF NUMERICAL CONTROL MAINTENANCE AND TRAINING

U. S. Atomic Energy Commission, Technical Information Center.
G. R. Bright, and W. A. Groppe. December 1972. 20 pages.

Y–IA–73–REV–2

PREVENTIVE MAINTENANCE PROGRAMS

U. S. Atomic Energy Commission, Technical Information Center.
G. R. Bright. December 1972. 22 pages.

Y–IA–110

OVERALL MACHINE EVALUATION

U. S. Atomic Energy Commission, Technical Information Center.
H. A. Tunnell. December 1972. 10 pages.

Y–NA–221

STRAIGHTNESS AND ALIGNMENT CHECKS ON MACHINE TOOLS

U. S. Atomic Energy Commission, Technical Information Center.
J. L. Huff. December 1972. 10 pages.

Y–NA–222

AUTOMATIC TOOL SETTERS

U. S. Atomic Energy Commission, Technical Information Center.
W. D. Cain. December 1972. 8 pages.

Y–NA–223

MECHANICAL MAINTENANCE OF PRECISION MACHINE TOOLS

U. S. Atomic Energy Commission, Technical Information Center.
S. M. Murphy. December 1972. 15 pages.

Y–NA–224

AN ANALYSIS OF A MAJOR TOOL REBUILDING PROGRAM

U. S. Atomic Energy Commission, Technical Information Center.
J. Conn. December 1972. 9 pages.

Y–NA–225

PRECISION CUTTING TOOLS

U. S. Atomic Energy Commission, Technical Information Center.
W. E. Stephens. December 1972. 11 pages.

Y–NA–227

SPINDLE THERMAL EFFECTS

U. S. Atomic Energy Commission, Technical Information Center.
T. A. Arehart, Jr. December 1972. 11 pages.

Y–NA–228

INTERFEROMETRIC TECHNIQUES IN DYNAMIC ERROR MONITORING

U. S. Atomic Energy Commission, Technical Information Center.
C. M. Lay, and J. H. Burkhardt, Jr. December 1972. 8 pages.

Y–NA–230

STATISTICAL TECHNIQUES IN MACHINE TOOL EVALUATION AND PROCESS QUALITY CONTROL

U. S. Atomic Energy Commission, Technical Information Center.
H. A. Fell. December 1972. 12 pages.

Y–NA–231

Machinery and Equipment (continued)

All of the above reports were prepared for presentation at a clinic on "Precision Machining and Gaging," which was held at Oak Ridge, Tennessee, in November 1972 under the joint sponsorship of the Union Carbide Corporation and the Society of Manufacturing Engineers. As indicated by the individual titles, the reports deal with many aspects of the subject: Machine components; control systems, including numerical control; gaging equipment and its application to precision machining; support equipment and activities; machine tool operation and maintenance; test methods and instruments; etc. The level of treatment ranges from broad surveys to consideration of specific designs. Emphasis is on experience gained at the Oak Ridge National Laboratory.

MACHINING DATA HANDBOOK. SECOND EDITION

Manufacturing Methods

Metcut Research Associates, Incorporated, Machinability Data Center. 1972. 1,000 pages.

AD–742 058

This document is comprised of an extensive series of tables and guidelines which are intended to provide starting recommendations for important machining situations in an effort to help all types of personnel associated in one way or another with material removal. The general areas covered include: Machining recommendations for various operations (turning, milling, drilling, threading, planning, broaching, sawing, grinding, etc.); tool geometry; cutting fluids; tool materials; surface finish and surface integrity; guidelines for drilling; machinability; grinding and abrasive machining; economics in machining; vibrations, chatter, and machine tool dynamics; numerical control and adaptive control; machining standards. Experience with the first edition has indicated that application of many of these machining data will provide increased productivity, reduced costs, and greater reliability of parts finished by machining processes.

SURFACE INTEGRITY OF ELECTROCHEMICAL MACHINING

General Electric Company. Guy Bellows. October 1969. 104 pages.

AD–746 875

"Surface integrity" is a generic term which refers to the reaction of a material to the impact of a specific manufacturing process. Electrochemical machining involves the removal of material by the anodic dissolution of portions of a positive workpiece separated from a shaped negative electrode (tool) by a moving conductive electrolyte. This document describes the general range of effects of electrochemical machining on some of the newer structural alloys. The effects of both standard and off-standard operating conditions are depicted. Post treatment effects are described in relation to conventional machining as well as electrochemical machining. General guidelines are provided, along with a bibliography for further study.

CENTER FOR HIGH ENERGY FORMING

Martin Marietta Corporation; E. F. Industries, Inc.; and University of Denver. I. R. Kramer, J. D. Mote, and A. A. Ezra. June 1972. 470 pages.

AD–748 416

The Center for High Energy Forming is an organization dedicated to the direct coupling of science and technology to develop techniques for the explosive forming of metals. This document is comprised of a series of survey papers and research reports which have been generated as a result of recent work at the Center. The topics covered include: Closed die explosive forming; elevated temperature explosive forming; explosive forming domes using truncated conical preforms; analyses of die stress during explosive forming; compaction of powders using explosives; explosive forming of pressure vessel steels; edge pull in explosively formed domes; design and analysis of explosive forming thin shell dies; radial piston approach to the dynamic autofrettage of thick walled forging dies; preliminary analysis of the market for custom metal heads: explosive thermomechanical processing; explosive welding.

HIGH-PERFORMANCE CASTINGS

National Materials Advisory Board. March 1972. 246 pages.

AD–748 462

Castings offer certain unique advantages over other methods of producing metal parts, the most noteworthy of which is the ability to economically produce complex shapes that are not achieved by other methods of fabrication. Those castings regarded as high-performance castings are efficient load-carrying structures, and are designed to withstand service stresses which represent a significantly high proportion of their ultimate strengths. This document delineates the factors influencing the characteristics, design, and properties of high-performance castings and the problems that must be resolved to increase their reliability and use. Programs and methods for improving the integrity and acceptance of such castings are suggested. Also, an effort is made to identify the information needed by designers to select appropriate casting design, materials, and inspection and acceptance criteria which would permit greater confidence in the use of casting in highly stressed applications.

◆

FORGED METAL POWDER PRODUCTS

TRW, Inc.; and Army Weapons Command, Research Directorate. Frank T. Lally, Istvan J. Toth, and Joseph DiBenedetto. August 1972. 96 pages.

AD–750 180

Powder metallurgy in general has not been applied to the fabrication of structural parts of critical components because the metal powder parts have not approached the mechanical properties or reliability of wrought materials. The reason for the inferior properties of metal powder parts is generally attributed to high residual porosity. A process of minimum deformation forging of metal powders has now been developed which is capable of producing low-alloy steel components with properties comparable to their wrought counterparts. Futhermore, lower production costs are possible with the new process as a result of the elimination of some of the forging operations usually required. Basically, the process involves the production of a preform by standard powder metallurgy techniques and subsequent full densification by hot precision forging to the final shape. This report provides a detailed description of the processes, gives a cost analysis, and discusses the advantages and limitations.

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FABRICATION OF OPTICAL ELEMENTS BY MEANS OF A LOW ENERGY ION BEAM

Frankford Arsenal. James D. Lester. 1972. 12 pages.

AD–750 347

Any process which shapes optical surfaces by means of mechanical abrasion does not have a well controlled material removal rate. This means that for the manufacture of precision high quality optics by abrasion, the figuring process must be interrupted at frequent intervals so that surface may be carefully measured. This report describes a new optical manufacturing process which represents the first significant departure from optical figuring techniques developed in antiquity. It employs a finely focused beam of energetic ions to sputter off surface atoms in a precise and well defined manner. The process is easily automated because it operates at the atomic level in an accurately controllable way. Furthermore, the new process greatly increases the freedom of the optical designer in specifying surface contours.

THE APPLICATION OF VIBRATIONAL ENERGY TO THE DRAWING OF METALLIC MATERIALS

Aeroprojects Incorporated. Nicholas Maropis. November 1966. 193 pages.

AD–803 590

Since the mid-1950's extensive work at the laboratory level has demonstrated that potentially significant advantages may be obtained by the application of vibratory (ultrasonic) energy to certain metalworking processes. These experimental studies have provided an impetus to the development of production-type ultrasonic equipment for metalworking equipment. As part of this effort, an investigation was undertaken on the application of ultrasonic energy to the draw die during drawing of rod and wire materials. High-intensity vibrational energy was applied in both the longitudinal and radial modes during the drawing of Ti-6Al-4V alloy, aluminum alloy, and steel rods. Reductions of 7 to 37% were effected at drawing rates up to 200 ft/min. Significant reductions in drawing force were obtained and surface finish was improved. The significance of ultrasonic power, vibratory amplitude, and vibratory velocity of the die was ascertained; and, also, ultrasonic equipment requirements were generally established. Reductions in drawing force were also obtained by the application of ultrasonic vibratory energy during the drawing of copper and steel wire; and various processing parameters were established for this operation.

HYDRODYNAMIC COMPRESSIVE FORGING

TRW, Inc. L. R. Kupfer, and A. L. Hoffmanner. February 1967. 136 pages.

AD–808 985

Hydrodynamic compressive forging is the technique by which a dynamic hydrostatic pressure is applied about the workpiece during the forging process. The utility of this technique has its origin in the improved ductility of materials when deformed under a hydrostatic pressure. This report presents the results of a process development study of hydrodynamic compressive forging, the purpose of which was to develop the benefits of applying the technique to materials of low ductility and to determine the pressure reductions possible by forging at temperatures up to 1000°F. The studies were performed on a molybdenum-base alloy, a nickel-cobalt alloy, and a beryllium alloy at temperatures from 70°F to 1000°, and involved three processes: upsetting, the forging of a radial flange, and the expansion of a ring.

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HEAT TREATMENT BY MOLTEN GLASS

North American Aviation, Inc. G. E. Martin. July 1967. 240 pages.

AD–818 132

Many metals and alloys, when subjected to heat-treatment to develop optimum mechanical properties, are susceptible to various surface reactions such as oxidation, scaling, decarburization, intergranular oxidation, etching, pitting, corrosion, alloy depletion, and contamination. The resulting surface defects usually have an adverse effect on mechanical properties and reliability; and machining and cleaning operations to remove the defects are costly and sometimes impractical. In an effort to overcome these problems, a process was developed whereby a workpiece is heat treated in a molten glass bath. The glass provides a protective coating until the workpiece cools, whereupon it spalls off due to the shrinkage of the metal. A water soluble borate-base glass was found to be suitable for heat-treating low alloy steels, tool steels, stainless steels, and molybdenum. The glass provided excellent surface protection for these materials, with little or no surface attack or defects and with no deterioration in mechanical properties. In addition, very little distortion was observed on relatively complicated parts.

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MEASUREMENT AND IN-PROCESS CONTROL OF SMALL BORES

Sperry Gyroscope Company. J. R. Hicks, M. R. Islam, L. A. Pally, F. Woo, and W. E. Morgan. March 1967. 373 pages.

AD–820 138

A program is described which was directed toward the development of an improved manufacturing capability for the production of ultraprecision small (0.025 to 1.0 inch) boreholes and to develop the necessary techniques of micrometrology in order to certify the accuracy of the holes produced. A material removal control techniques was developed which represents an advance in the state of the art. Within reasonable limits of metal removal per cycle, a true bore to microinch accuracy can be obtained in one machining cycle regardless of the imperfections of the hole prior to boring. Improved productivity and reliability due to reduced production times and extended tool life are expected.

MACHINING OF NEW MATERIALS

Metcut Research Associates, Inc. Norman Zlatin, Michael Field, William P. Koster. October 1967. 389 pages.

AD–824 483

This document provides data on the conventional machining characteristics of some of the newer alloys. The alloys involved are: High-strength steels (12% nickel grade 180 solution annealed maraging, 12% nickel grade 180 aged maraging, annealed AISI 4340, normalized AISI 4340, D6AC, HY-Tuf); stainless steels (solution treated 17-4 PH, solution treated and aged 17-4 PH, AM-355, AFC-77, annealed 440C, quenched and tempered 440C); titanium alloys (Ti-6Al-4V, annealed Ti-6Al-6V-2Sn, aged Ti-6Al-6V-2Sn, Ti-6Al-2Sn-4Zr-2Mo); and nickel-base alloys (solution treated Udimet 700, solution treated and aged Udimet 700, Alloy713C). The machining processes considered are turning, milling, drilling, reaming, tapping, and grinding. An attempt is made to provide all of the information which a tool engineer would need to set up a particular machining operation on a given alloy. Also included are results of an investigation on the extent to which several of the test materials retain the surface properties of the bulk material after being subjected to various machining operations.

CONTINUOUS SLIP CASTING PROCESS FOR THE PRODUCTION OF METAL STRIP AND SHEET

Chrysler Corporation, Amplex Division. Dean L. Lyon. January 1968. 113 pages.

AD–831 843

A practicable slip-cast metal strip manufacturing process has been developed which overcomes the major difficulties usually encountered when attempting to produce strip and sheet from the new superalloys from cast billets. The process, which was demonstrated with the alloys IN-100, Udimet 700, Waspalloy, and X-40, essentially involves suspending metal powders in a viscous organic colloid which is then continuously cast on a rotating wheel and caused to coagulate and stiffen into strip. The product may then be densified to the required degree, usually by rolling. Tests on the slip-cast strip indicates that it is fine grained, and is comparable in chemical and mechanical properties to the as-cast alloys.

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PRODUCTION PROCESSES FOR EXTRUDING, DRAWING, AND HEAT TREATING THIN STEEL TEE SECTIONS

Northrup Corporation, Norair Division; H. M. Harper Company. A. L. Scow, and P. E. Dempsey. October 1968. 97 pages.

AD–841 689

An economically practical manufacturing process is described for extruding, drawing, and heat treating thin tee shapes of steel. It was found possible to produce 20-foot-long sections of 0.062-inch-thick steel by extrusion. The sections could be further reduced in thickness by drawing (at room temperature) to 0.040 inch. The extrusion procedures, lubrication, heat treatment, and mechanical property tests are described in detail. Also included is a fast, inexpensive method for selecting extrusion glass lubricants.

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DIE MATERIALS FOR HOT EXTRUDING STEEL AND REFRACTORY MATERIALS

Allegheny Ludlum Steel Corporation. F. S. Turner. October 1968. 237 pages.

AD–845 105

The main deterrent to the proper production of shaped extrusions lies in the method of manufacture and the performance of the extrusion die. Die material development is a major consideration in this aspect, as extrusion at high temperatures involves not only proper die design for balanced flow but also imposes stringent mechanical impact and stress conditions on the die material. This report provides the results of a program in which over fifty candidate die materials were evaluated for their suitability for use in the hot extrusion of steel and refractory metals. The materials involved included ceramics, cermets, metal ceramic composites (including fiber reinforced materials), and electrophoretic deposited carbide coatings. It was demonstrated that ceramics and cermets, when adequately supported, show considerable potential as extrusion die materials.

ADVANCED CHEMICAL MILLING PROCESSES

Grumman Aircraft Engineering Corporation. Carl Micillo. August 1968. 214 pages.

AD–847 070

This report provides the results of a program which was undertaken to improve chemical milling processes and associated equipment that employ straight chemical energies. Emphasis was placed on the control elements for more effective and precise fabrication at lower costs. Some results include: Improved control when chem-milling aluminum plate materials; clarification of process relationships of chem-milling with other manufacturing techniques (forming, machining, welding, heat treating, etc.); raising of confidence level in titanium chem-milling; development of a monoacid chem-mill process that resulted in cost reductions when chem-milling titanium; optimization of chem-milling process for refractory metals which allows the maintenance of structural integrity of the material; optimization of the chem-milling process for beryllium, nickel-base alloys, and high strength steels; development of an improved, nonflammable, maskant; development of a control system for chem-milling aluminum which automatically, and at a lower cost, analyzes the solution, maintains the etchant concentration, and detects the etch rate.

DEVELOPMENT OF IMPROVED GRINDING PROCESSES

Avco Corporation. G. C. Mullin, and R. E. Wetherby. September 1968. 232 pages.

AD–850 204

The greatly increased usage of nickel-base alloys has resulted in a focusing of attention on the many problems associated with the grinding of parts from these alloys. Two major problem areas exist which complement each other: (1) The remarkable rise in production time and tooling requirements as compared to the requirements of grinding more conventional materials; and (2) the peculiar susceptibility of these materials to adverse changes in metallurgical properties induced by the grinding process. This document gives the results of a program which was undertaken in an effort to overcome some of these difficulties. The major achievements were: The development of effective grinding aids resulting in increased metal removal rates with decrease in grinding damage; correlation of the grinding behavior for a series of high-strength alloys, and optimization of grinding variables resulting in increased grinding efficiencies; and determination and reduction of material damage due to grinding through selection of grinding variables.

MANUFACTURING TECHNIQUE FOR LOW TEMPERATURE SILICON DEPOSITION

RCA Laboratories. D. Richman, R. H. Arlett, and J. P. Dismukes. June 1969. 87 pages.

AD–855 286

Present epitaxial silicon manufacturing process technology employs temperatures in the range of 1200°C for both substrate etching and layer growth. A lower temperature process would be desirable because of reduced chances of unwanted contamination and equipment failure, reduced power requirements and operating costs, and other reasons. A new system, which is compatible with present-day manufacturing technology, has been developed that allows epitaxial single-crystal films of silicon to be grown at high rates on silicon substrates by the pyrolysis of silane at temperatures as low as 800°C. The ability to prepare material of device quality was demonstrated by the preparation of diodes and transistors. A low-temperature gaseous silicon etching process was also developed.

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HIGH VELOCITY FORGING TECHNOLOGY

LTV Aerospace Corporation, Vought Aeronautics Division. D. W. Truelock, J. R. Russell, and C. M. Phelan. November 1968. 347 pages.

AD–858 513

The dynamic response of metal alloys deformed under very high loading rates has attracted special interest. In some instances, improvements in the workability as well as the mechanical properties of the finished part can only be attributed to the fact that during deformation the material is subjected to high sustained strain rate. In the high energy impact forging process, velocity is substituted for mass to rapidly impart high levels of energies to the workpiece both in terms of shock loading and rapid deformation. This document describes the effect of forging velocity (strain rate) on the ductility and toughness of a representative group of alloys in a temperature range from ambient to 1950°F. First the overall dynamic effects are given over a zero to 8000 in/in/sec strain rate range. Then consideration is given to the effects of increasing the number of impact velocities as well as varying the amount of deformation at each velocity and forging temperature. The effect of temperature in the forging process and material response to post forming heat treatment is also dealt with.

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EXTRUSION OF CLAD METALS

Lehigh University. Betzalel Avitzur. September 1969. 56 pages.

AD–860 249

It is sometimes impossible to extrude a hard material without causing fracture to the product. A method for avoiding this involves encapsulating the hard material in a soft container. This billet is placed in an extrusion chamber and is extruded by pushing a ram into the chamber. As the billet is pushed out of the chamber, it undergoes a reduction in cross-section, with a result that the hard core is reduced in diameter and elongated. Two other major advantages to encapsulating or cladding a hard metal with a soft one are: (1) When the hard metal core occupies only a small part of the volume of the extrusion chamber and the remainder is filled with a soft metal, larger reductions may be obtained with a given available extrusion pressure; and (2) cladding can produce desired properties in the extruded rod, including strength provided by the core and surface corrosion protection provided by the soft cladding. In this document, criteria are developed for the choice of the material properties and geometry that will assure plastic flow with no fracture of the core. The ram pressure required to perform the extrusion is expressed. A few design guidelines are presented.

DEVELOPMENT OF CONVEX FACE DRAW DIE

Harvey Aluminum (Incorporated). D. Q. Cole. October 1969. 77 pages.

AD–860 711

Extrusion provides a means of quickly, simply, and economically making shapes from raw billet stock in a single operation. As might be expected, thick heavy sections are more readily extruded than small thin ones. In general, thicknesses less than 3/16 inch and sectional areas less than ¾-square inch are quite difficult to attain. It has now been demonstrated that by the use of dies with convex faces, it is possible to draw long thin sections to thicknesses and tolerances that hitherto could be achieved only by expensive machining. This type of die provides better lateral distribution of metal in drawing, thus greatly reducing the effects of billet thickness variations and avoiding distortion and tearing of the metal. It was found possible to cold draw steel and hot draw titanium alloy to a thickness of 0.040-inch within a ±0.002-inch tolerance.

BACK TENSION DRAWING PROCESS

Whittaker Corporation, Nuclear Metals Division. E. J. Kosinski, J. J. Pickett, and P. Loewenstein. July 1969. 145 pages.

AD–861 485

Long structural shapes are usually produced by hot rolling or hot extrusion followed by drawing through shaped dies. The principal problem encountered in drawing of thin extruded sections is the excessive bending and twisting which occurs during drawing. This bending is difficult to remove subsequently and frequently leads to breaks in the drawn section. The feasibility of a new process, termed back-tension drawing, which avoids these problems has been demonstrated. In this method the section to be drawn is held in tension at a stress level close to that of the yield point by applying a force at the rear end of the section. While under tension, the section is drawn through the die as in a conventional drawing operation. It was found possible to cold draw steel T sections to a thickness of 0.040± 0.001 inch thickness with negligible bow, camber, and twist. Preliminary trials indicate that the process is also adaptable to titanium alloys.

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HIGH PRESSURE EXTRUDING

Allegheny Ludlum Steel Corporation. P. A. Santoli. August 1969. 146 pages.

AD–862 626

The production potential of an extrusion tooling system which operates at a nominal stem stress of 300 ksi has been investigated and demonstrated. It was found that this higher pressure will permit a significant increase in the extrusion ratio, a decrease in billet temperature, and will improve the product. This report describes the design of the system and the effects of such variables as unit pressure, lubricant material, and tooling design on the extrusion of steel and titanium.

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A HIGH TEMPERATURE ALLOY DIE CASTING PROCESS

General Electric Company, Lamp Metals and Components Department. D. J. McMillin. August 1969. 491 pages.

AD–863 198

Die casting is a process in which molten metal is injected, under pressure, into a split, metallic, permanent mold. The inherent economic and technical advantages of the die casting process have made it common practice in industry for years for metals which have liquidus temperatures less than 900°C (Lead, tin, zinc, magnesium, aluminum). This report describes a project to adapt the die casting process to the production of sound, dimensionally accurate castings from ferrous alloys of high melting point, at a cost below that possible employing other casting techniques and metalworking processes. Consideration is given to melting, liquid metal transfer, pressure injection, die design, casting quality, and cost. Although the project involved only ferrous alloys, the conclusions reached should also be applicable to other alloys having liquidus temperatures in the 900°C to 1600°C range (cobalt, copper, iron, nickel, and their respective alloys).

MANUFACTURING TECHNIQUES FOR CONTROLLED DEPOSITION AND APPLICATION OF DOPED OXIDES

RCA Electronic Components, Advanced Technology Laboratory A. Mayer, K. Strater, and D. A. Poutinen. September 1970. 134 pages.

AD–875 321

This report describes the development of a manufacturing processing technique for reproducibly depositing a doped oxide for semiconductor device fabrication. The basis for this development was the study of the chemistry and kinetics of the oxidation of silane, phosphine, and diborane. A greatly improved gas handling and dilution system was designed, and a close-space horizontal deposition reactor was developed. The technique for the precise control of oxide composition and, hence, of surface concentration and junction depth was applied successfully to transistor fabrication. Several of the reactors were put in operation for the production of integrated circuits and silicon devices.

VACUUM MELTING AND CASTING OF SUPERALLOYS

Battelle Memorial Institute. M. C. Hebeisen, H. J. Wagner, S. G. Nelson, et al. 1971. 179 pages.

N71–25891

The superalloys constitute a group of high temperature alloys based on nickel and cobalt. The National Aeronautics and Space Administration has been a major contributor to the technology associated with these materials, and this document represents an effort to transfer some of this technology to the industrial, educational, and professional communities. It deals mainly with the latest techniques in processing superalloys, with emphasis specifically on vacuum melting and casting. The areas covered include: Compositions, properties, and applications of superalloys; factors important in melting and casting; current and potentially important melting processes (vacuum induction melting, vacuum arc melting, electroslag remelting, electron beam melting); vacuum casting of superalloy shapes (the process, making the disposable pattern, molds and cores, melting and casting, sizes and tolerances, possible future trends).

ULTRAFINE GRINDING OF SEVERAL INDUSTRIAL MINERALS BY THE ATTRITION-GRINDING PROCESS

Bureau of Mines, Tuscaloosa Metallergy Research Laboratory. Martin H. Stanczyk and I. L. Feld. 1972. 28 pages.

PB–210 983

Along with an increased use of nonmetallic industrial minerals in recent years is a rise in demand for finely divided mineral filler materials in such fields as paints, plastics, and rubber products. If the subject mineral is one refractory toward conventional grinding methods, a specialized technique is needed. A process termed attrition grinding has been developed, involving intense agitation of a slurry composed of the material to be ground, a relatively fine grinding medium, and a suspending fluid. A report is given on the batch grinding of six minerals—mica, pyrophyllite, talc, marble, barite, and fluorite—to investigate the effectiveness of the method. The attrition grinder is described, and results are noted for the variables of feed pulp density, grinding medium size, and electric power requirements. The data are presented largely in tabular and graphic form.

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EXPLOSIVE FORMED REINFORCED HOLLOW BEAMS

California State Polytechnic College, School of Architecture and Environmental Design. David R. Saveker. November 1970. 52 pages.

PB–212 612

The reinforced hollow beam concept essentially consists of forming a rectangular section outer skin, similarly forming a smaller section inner skin, placing a wire reinforcing grid between the two skins, and blasting the inner skin against the outer skin by means of a line of explosive charge in a split die container. This document provides details on the process using several combinations of steel, aluminum, and stainless steel materials. It also explores several applications for the beams so fabricated. These include: Conduits for electrical, plumbing, and drainage lines in housing applications; carrying hydraulic ventilation, fuel, control cables, and electrical harnesses in an aircraft wing span; lightweight frame assemblies for automobiles; in general, any application where a span structure is needed which can serve the double purpose of systems routing and protection.

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Manufacturing Methods (continued)

MACHINING AND GAGING INFORMATION 1971 ANNUAL INDEX

Union Carbide Corporation, Machining and Gaging Information Center. A. M. Read, and D. L. Simpson. April 1972. 210 pages.

Y–SC–37

This document contains bibliographic entries and abstracts pertaining to the high-accuracy, close-tolerance aspects of machining and dimensional measurement, or to unique applications of equipment and methods. The entries represent technical journal articles, professional society papers, technical reports, and books, most of which were published in 1971. Title subject, personal author, and corporate author indexes are included. The sources where the publications (other than technical journal articles) may be obtained are indicated. The 1970 Index was described in AMTID, July 1972, page 51.

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Marine Engineering

CARGO CONTAINMENT PANEL REPORT ON PRESSURE RELIEVING SYSTEMS FOR MARINE BULK LIQUID CARGO CONTAINERS

National Academy of Sciences. 1971. 118 pages.

AD–744 681

Cargo containment technology is receiving increased attention as it relates to overpressures encountered under emergency situations during the marine transport of bulk hazardous liquid cargoes. Pressure vessels for liquid cargoes have a pressure level at which failure occurs, releasing the contents, so that pressure relieving systems are necessary to prevent attainment of a rupture pressure level. Personnel safety and property safety are both involved. The document reports on proposal of a new formula for relief valves, reflecting more adequately the present knowledge and engineering practice, with especial reference to fire exposure of cargo vessels. A specific list of overpressure causes is discussed, including insulation deterioration, heat flux, operating errors, and malfunction of the relief valve.

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STATE-OF-THE-ART OF MARINE SOIL MECHANICS AND FOUNDATION ENGINEERING

Army Engineer Waterways Experiment Station, Soils and Pavements Laboratory. Shun C. Ling. August 1972. 176 pages.

AD–747 366

Underwater construction engineering is rapidly increasing and becoming highly diversified. As a consequence there is increased awareness that capabilities of analyzing the special problems in underwater construction have lagged behind. This report provides the results of a study of the state-of-the-art of marine soil mechanics and engineering and, based on the findings, presents recommendations for future research. The areas investigated include subbottom exploration, testing of marine soils, marine soil properties, marine foundation engineering, dredging, and underwater fills. Consideration is limited to water depths of 600 feet or less. A bibliography of about 200 entries is included.

CONTAINERIZED CABLE STOWAGE

General Motors Corporation, Delco Electronics Division. J. Melendez. March 1971. 114 pages.

AD–747 704

This report describes the development of a containerized cable system which may be used for the packaging, storage, and deployment of wire rope cables. Possible marine applications of such a system include towing, cable laying, salvage, and mooring. Continuous wire lengths between 100,000 feet (for ⅛ inch diameter cable) and 2,000 feet (1 inch diameter cable) weighing approximately 6,000 pounds can be packed in coil envelopes 40 inches in diameter and 40 inches long, and cables above 1 inch can be packaged in coil envelopes within 6 feet x 6 feet. The container designs are optimized for standardization in handling and time response in cable deployment. Appendices to this report give consideration to wire rope coatings and protection, and to general properties of wire rope.

ATTENUATION OF WIND-GENERATED DEEP WATER WAVES BY VERTICAL JET BREAKWATERS

University of Massachusetts, School of Engineering. John M. Lacouture, Joseph M. Colonell, and Charles E. Carver, Jr. June 1972. 128 pages.

AD–748 190

Ever since the invention of the pneumatic breakwater in 1907, experimenters from all over the world have at one time or another tested the device, theorized as to its operation, and concluded in one way or another as to its effectiveness as a wave attenuating device. The realm of testing came to include the hydraulic breakwater. In spite of global research investigating both devices, the breakwater's mode of operation has remained unclear. This report gives the results of a study which was undertaken to determine the operational characteristics of the two types of breakwaters in a wind-generated wave environment. This was accomplished by measuring wave heights both upstream and downstream of operating breakwater. Data were obtained for various discharges of the breakwaters and for various combinations of the breakwaters. This was done to determine the most efficient operating procedure over the range of discharges and combinations.

HYDRAULIC TOOLS AND EQUIPMENT FOR UNDERWATER SALVAGE

Naval Civil Engineering Laboratory. G. Lonn Liffick, and Fred B. Barrett. July 1972. 38 pages.

AD–748 585

This report contains the results of a program for the evaluation of commercially available hydraulic equipment to determine its suitability for underwater salvage work. Hydraulic pumping, rigging, load handling, and cutting devices were tested to determine their diver performance characteristics and mechanical suitability for underwater operation. It has been found that divers can be utilized as prime movers for some small jobs and that some conventional surface hydraulic equipment can be used underwater for reasonable periods of time with a minimum of additional maintenance. Surface hydraulic equipment suitable for underwater operation includes manual pumps, rams, cylinders, and several cutters.

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OCEAN RESOURCES LAW

University of Oregon, School of Law. Elisabeth Mann Borgese, Thomas A. Clingan, Jr., Hollis M. Dole, et al. 1971. 252 pages.

COM–72–10897

This document is comprised of a series of papers dealing with international aspects of ocean resources management. The topics covered include: Ocean politics at the United Nations; organizing to probe the oceans; regulation of hard-mineral mining on the continental shelf; international law and Canada's anti-pollution legislation; international and national approaches to oil pollution responsibility.

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Metrology

PRECISION MEASUREMENT AND CALIBRATION. VOLUME 5—FREQUENCY AND TIME

National Bureau of Standards, Institute for Basic Standards. B. E. Blair, and A. H. Morgan (Editors). June 1972. 560 pages.

COM–72–50696

This book contains reprints of 57 papers by NBS authors with work in the area of frequency and time. The papers were originally published during the period 1960-1969. The general subject areas covered include frequency and time standards, time scales, distribution of frequency and time signals, and statistics of frequency and time measurements. A bibliography of 227 selected references to the worldwide literature on frequency and time is provided. Author and subject indexes are included. (Other books in this series which are currently available from NTIS are *Volume 7—Radiometry and Photometry,* COM-72-50067, $7.00; and *Volume 9—Colorimetry,* COM-72-50697, $5.50.)

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THE EVOLUTION AND UTILIZATION OF MARINE MINERAL RESOURCES

Massachusetts Institute of Technology. H. S. Lahman, and J. B. Lassiter, III. June 1972. 240 pages.

COM–72–11043

In recent years interest in the oceans has increased enormously, particularly with respect to their potential to supplement land resources. The oceans, however, provide unique environments with unique problems. This report is an introduction to marine geologic resources and to the exploration methods available for locating these resources. It also provides background material for individuals in other disciplines whose work is sometimes related to these resources. Specific topics include: The rock cycle; erosion, transportation, and deposition; sedimentary rocks and environments of deposition; landforms and orogeny; stratigraphic correlation; localization of petroleum resources; localization of solid mineral resources; general approach to resource exploration techniques; geological and geochemical methods; seismic methods; gravity methods; magnetic methods; electrical methods; electromagnetic fields; oceanographic methods; exploration state of the art and costs.

ANALYSIS OF 169 CRUDE OILS FROM 122 FOREIGN OILFIELDS

Bureau of Mines, Bartlesville Energy Research Center. E. P. Ferrero, and Dorothy T. Nichols. 1972. 117 pages.

PB–210 254

Crude oil characteristics and properties are of interest to producers, refiners, and marketers of petroleum, to industrial consumers, and to various governmental organizations. Geologic data and chemical and physical properties are also of interest to persons who perform petroleum exploration and petroleum product research. As part of an effort to supply this type of information, this report presents the results of crude oil analysis of 1969 samples from oil fields in Africa, Asia, Australia, the Caribbean, Europe, North America (except the U.S.), and South America. Table show the geographic and geologic origin of the samples, annual production for the fields, general characteristics and analytical and computed data, hydrocarbon-type data, cumulative production of the larger fields, and references to sources of geological and field development information.

STANDARDIZATION OF CONTINUOUS MINER CONTROL CONFIGURATIONS

Applied Sciences Associates, Inc. William G. Hedling, and John D. Folley, Jr. June 1972. 27 pages.

PB–211 423

Continuous miners are operated in an environment which is extremely hazardous to mining personnel working in the vicinity, including the operator of the continuous miner. The controls for operation of these devices do not conform to modern principles of human engineering. Although the functions performed by most continuous miners are very similar, the control configurations associated with operator control of these functions differ significantly. This lack of standardization can produce a high incidence of error in operating the machines, making the man-machine systems a potential source of accidents. This report provides the results of an investigation of the characteristics of continuous miner operation and suggests ways in which human engineering technology could be applied in a practical way to help correct this situation. Emphasis is on the placement, motion, coding, and labeling of controls.

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TECHNOLOGY AND USE OF LIGNITE. PROCEEDINGS: BUREAU OF MINES—UNIVERSITY OF NORTH DAKOTA SYMPOSIUM, BISMARCK, N. DAK., MAY 12-13, 1971

Bureau of Mines, Grand Forks Energy Research Laboratory. Wayne R. Kube, and James L. Elder (Editors). 1972. 152 pages.

PB–211 826

This document is comprised of papers prepared for the sixth in a series of biannual symposia organized for the presentation of recent advancements in research and utilization of low-rank fossil fuels, with emphasis on lignite. The subjects covered include coal mine health and safety; removal of fly ash from stack gases generated by the combustion of low-sulfur coal; pipeline transportation of coal; liquefication of lignite using carbon monoxide and water at elevated pressure; air quality criteria; future energy supplies; and details of a 235 mw electrical generating station using cyclone burners, including construction and equipment costs.

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PRESSURE DISTRIBUTION IN IRREGULARLY BOUNDED RESERVOIRS

Bureau of Mines, San Francisco Energy Research Laboratory. R. V. Higgins, and A. J. Leighton. 1972. 28 pages.

PB–211 966

A computer method is described which is intended to provide the petroleum engineer with a means of quickly determining the pressure distribution in a petroleum reservoir. Information may thus be obtained that aids in optimizing the operation of a reservoir. The method is essentially an expansion to irregular boundaries of a procedure previously developed for reservoirs with regular boundaries (see PB-209 537 in AMTID, January 1973, page 67). The calculations involved are designed for one or a series of steady-state flows to determine the pressure distribution at a specific time. The computer program listing and its working details are described in the report. Two specific examples are shown to illustrate the processing details and capability of the program.

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SYSTEMS ANALYSIS OF AN INHERENTLY EXPLOSION-PROOF COAL MINING OPERATION

Westinghouse Defense and Space Center. August 1972. 383 pages.

PB–211 980

Tests have proved that man can work efficiently in any nontoxic atmosphere if its oxygen content remains at a minimum of 3 pounds per square inch, regardless of the total pressure; and it has been demonstrated that a combustible gas such as methane will not burn when the oxygen content of a gas mixture containing it falls below 12 percent by volume. These findings make possible the creation of an explosion proof atmosphere in coal mines, in which the accumulation of methane gas may reach high levels. The report discusses the production of a mine atmosphere with an oxygen concentration of only 10 percent, approximately 3 psi partial pressure, which will support human activity but not methane combustion. It covers circulation requirements, oxygen dilution, removal of coal dust, moisture, and carbon dioxide; transfer and entrance locks, control and sensing equipment, physiological effects, cost analysis, emergency operations, and the movement of equipment, personnel, coal, and waste. The system design includes computerized control.

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EXPLORATION OF ILLUMINATION CONCEPTS FOR UNDERGROUND COAL MINES

Crouse-Hinds Company, Construction Materials Products Division.
Rupert O. Yantz. May 1972. 367 pages.

PB–212 070

The lack of adequate area lighting in the working places of underground coal mines currently presents a hazard to the personal safety of the individual miner and is certainly a contributing factor to the mine accident rate involving serious injury to personnel and damage to mining equipment. This report describes two prototype lighting systems which were developed to demonstrate the feasibility of interim lighting equipment; it also provides recommendations for long-term solutions for working place lighting in underground coal mines. A prototype man-portable area lighting system was developed to meet the operational requirements of conventional mining. A machine-mounted prototype lighting system was developed to meet the requirements of mechanized mining. An illumination system concept using portable area lights for entry lighting, and roof support mounted lights for face lighting was recommended to meet the operational requirements of longwall mining.

STORAGE STABILITY OF GASOLINE. DEVELOPMENT OF A STABILITY PREDICTION METHOD AND STUDIES OF GASOLINE COMPOSITION AND COMPONENT REACTIVITY

Bureau of Mines, Bartlesville Energy Research Center. F. G. Schwartz, M. L. Whisman, C. S. Allbright, and C. C. Ward. September 1972. 64 pages.

PB–212 555

When gasoline is stored for extended intervals before use, some of its components react with oxygen in the air and with one another to form new, higher-molecular-weight materials commonly called gum. The ability of gasoline to resist such changes in its composition as time passes is referred to as its stability. This report describes a rapid and precise method for predicting the storage stability of motor gasolines. The method results from the investigation of many analytical techniques as well as a study of fuel composition and fuel component gum-forming mechanisms. The results of these development studies are discussed.

TRENDS IN THE MINERAL INDUSTRY, 1970

Bureau of Mines, Division of Mining. September 1972. 96 pages.

PB–212 556

This document provides an outline of worldwide developments, trends, and outlook for both mining and metallurgy in the minerals industry. Some of the topics covered are: Exploration, mining methods, fragmentation, ground support and control, materials handling, environmental control, health and safety, beneficiation, hydrometallurgy, electrometallurgy, pyrometallurgy, waste treatment, magnitude of the mining industry, comparison of production from surface and underground mines, ratio of ore to marketable product, and explosives. In addition, a special section is included concerning trends in ore flotation methods during the period 1960-1970.

PERFORMANCE CHARACTERISTICS OF COAL-WASHING EQUIPMENT: DENSE-MEDIUM CYCLONES

Bureau of Mines, Pittsburgh Energy Research Center. A. W. Deurbrouck, and J. Hudy, Jr. September 1972. 40 pages.

PB–212 656

Good performance data are a prerequisite to the design of a new coal preparation plant or to the expansion of existing facilities, and they serve as a yardstick with which the engineer may measure the performance of his plant. Having such data and a washability analysis of the raw coal enables the preparation engineer to make a rational choice of washing equipment. This report provides performance data on dense-medium cyclone washers, in which finely ground magnitite suspended in water is used to effect a separation between coal and its associated impurities in a centrifugal field. The dense-medium cyclone is shown to be an effective device for washing coal from ¾ inch top size to 28 mesh bottom size. The units are able to provide very sharp separations, even in the presence of large percentages of near-gravity material.

THE MINER, HIS JOB AND HIS ENVIRONMENT: A REVIEW AND BIBLIOGRAPHY OF SELECTED RECENT RESEARCH ON HUMAN PERFORMANCE

National Bureau of Standards. C. Fried, V. M. Forbes, K. P. Giles, S. J. Mumford, R. D. Peterson, E. M. Robertson, and J. R. Cornog.

PB–211 732

Ergonomics may be defined as the scientific study of the relationship between man and his work environment to achieve optimum adjustment in terms of efficiency, health, and well being. Unlike the traditional method which considers only the operating efficiency of the machine, the ergonomic method considers interactions of the man-machine system. This document provides a review of the literature on ergonomics as it applies to mining. Consideration is given to the following: The physical and mental stresses present in mining tasks; the effect of environmental stress on productivity; accident prevention measures; protective equipment and clothing; relationships between the miner and mining machinery; training programs; shift work and its effect on accident rates; aspects of the physical environment in the mine; psychological principles that have been applied to miners and their jobs. A bibliography of 1187 entries is included.

EVALUATION OF HORIZONTAL DRILLING TECHNIQUES IN COAL BEDS

Jacobs Associates. T. N. Williamson. October 1972. 137 pages.

PB–212 746

This report provides an evaluation of methods and techniques for drilling small diameter boreholes in coalbeds. Its purpose is to provide guidelines for meaningful research leading toward improved drilling devices and techniques. The first section describes the physical conditions under which a drill must work. This is followed by a discussion of the state-of-the-art of horizontal drilling, both in the U. S. and elsewhere. Descriptions and evaluations are then provided of thirty-six individual horizontal drilling concepts. Finally, details of research programs are given for a number of promising research projects.

A NEW CONCEPT FOR *in situ* COAL GASIFICATION

University of California, Lawrence Livermore Laboratory. G. H. Higgins. September 1972. 29 pages.

UCRL–51217–REV–1

Attempts to produce fuel gases from coal by *in situ* processing techniques began in the mid-nineteenth century. However, none of the techniques thus far developed are applicable to very deep coal deposits because the expense of digging the necessary deep shafts and tunnels would be prohibitive and because the gas produced would be of such low quality that a pipeline would be economically unfeasible. A new method is now proposed for the *in situ* gasification of coal in beds between 600 and 3,000 feet deep which would overcome these difficulties. Basically, the method involves shattering the coal with conventional explosives and converting it to methane through chemical reactions with oxygen and water. The proposed concept is described and then discussed from the viewpoint of the chemical reactions involved, the process engineering, and the economics of the method.

Nondestructive Testing

THE EXAMINATION OF DISCONTINUITIES IN WELDS BY STEREORADIOGRAPHY

Construction Engineering Research Laboratory. K. W. Carlson, and F. V. Lawrence. September 1972. 16 pages.

AD–749 459

Present nondestructive techniques for examining the characteristics of flaws in welds are not entirely adequate because they offer only a two-dimensional observation of the weld. The feasibility and practicability of using stereoradiography for obtaining three-dimensional measurements of weld flaws has now been demonstrated. This technique, which until now has been largely used only in the medical profession, entails viewing a radiographic stereo-pair through a stereo-viewer. Depth calculations of weld flaws may be obtained from paralax measurements on the stereo-pair and the application of photogrammetric principles. Details of the technique, its application, and necessary equations are provided in the report. Although the method in its present state of development is not considered suitable for field use, it could be implemented in laboratory or manufacturing applications with minimum modification.

NONDESTRUCTIVE TESTING OF FLEXIBLE PAVEMENTS. A LITERATURE REVIEW

Army Corps of Engineers, Waterways Experiment Station. J. W. Hall. May 1970. 35 pages.

AD–869 528

It has long been the desire of pavement engineers to develop some rapid nondestructive means of assessing the strength or load-carrying capability of highway and airfield pavements. This work summarizes the investigations and outstanding findings given in the literature in the field of nondestructive pavement testing. The topics covered include: Factors affecting pavement deflection; deflection masurement; allowable deflection; radius of curvature; laboratory fatigue studies; prediction of performance from small-scale deflections; wave velocity measurements; stiffness measurements; Lane-Wells deflectometer; dynamic laboratory testing.

INSPECTION OF FINE-PITCHED GEARS

Bendix Corporation, Kansas City Division. C. W. Berry, Jr. March 1972. 47 pages.

BDX–613–563 (Rev.)

A system is described for checking minature rolling gears which has capabilities greater than are currently possible with commercial equipment. The machine is able to test fine-pitched gears of between 0.5 and 8 ounces, and to detect changes in pitch diameter with an accuracy of 0.000030. This increased capability was obtained by reducing the mass of moving members, using a pivot motion to reduce friction, and using an air-actuated gaging transducer to provide the necessary gaging pressure.

AN ANALYSIS OF THERMAL TRANSIENT TESTING

Sandia Laboratories (AEC). Richard A. Adams. December 1970. 48 pages.

SC–RR–70–635

The welding of small electrical connectors has become a major process in the assembly of electronic components. Because of the small size of the various parts involved, the more conventional nondestructive inspection techniques such as x-rays and die penetrants cannot be used. Present post-welding inspection methods are either destructive or are not sensitive enough to yield quantitative

Nondestructive Testing (continued)

data on the actual strength of the welds. A new method has been developed which overcomes these difficulties through the utilization of the thermal and electrical properties of the bond itself. The method has been labeled "Thermal Transient Testing". A description of this nondestructive weld testing method, and an analysis of the effects of variables associated with it, are given in this report.

AN INTRODUCTION TO ACOUSTIC EMISSION

University of California, Lawrence Radiation Laboratory. R. G. Liptai, D. O. Harris, and C. A. Tatro. May 1971. 21 pages.

UCRL–73209

Acoustic emission may be defined as the stress or pressure waves generated during dynamic processes in materials. In general, the use of sounds or acoustic emissions has been largely neglected by the scientific and engineering communities as a parameter to characterize the use, or abuse, of a material subjected to load. However, this situation has been generally reversed since the early 1960's, stimulated largely by investigations into the sounds produced by metals undergoing deformation. This document briefly reviews acoustic emission technology. It includes a brief historical survey, a discussion of materials research and characterization, and a review of the application of emission techniques to the evaluation of structural integrity. Also, some discussion of future prospects for acoustic emission technology is presented.

Nuclear Technology

A REVIEW OF ALPHA RADIATION SOURCE PREPARATION METHODS AND APPLICATIONS

Oak Ridge National Laboratory, Isotopes Development Center. R. E. Green, R. S. Pressley, and F. N. Case. October 1972. 54 pages.

ORNL–4819

Included among the current applications of alpha particle sources are gas pressure and density gages, relative humidity gages, thickness gages, static eliminators, radioactive lightning rods, ionic conditioning of air, flow measurement, and various analytical procedures. This document provides a survey of the literature on the properties of alpha particles, alpha sources, and alpha-emitting nuclides; the preparation of alpha sources; integrity; evaluation and standardization; and uses. About 200 bibliographic references are cited.

BIOENVIRONMENTAL EFFECTS ASSOCIATED WITH NUCLEAR POWER PLANTS; A SELECTED BIBLIOGRAPHY

Battelle Columbus Laboratories. Ramona A. Mayer, Ann W. Rudolph, Duane E. Bell, and Richard S. Davidson. June 1972. 296 pages.

TID–26164

This bibliography contains 466 abstracts of publications concerning the effects of nuclear power plants on the environment. Subject, author, and report number indexes are included.

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A SELECTED, ANNOTATED BIBLIOGRAPHY OF THE CIVIL, INDUSTRIAL, AND SCIENTIFIC USES FOR NUCLEAR EXPLOSIVES

U. S. Atomic Energy Commission, Technical Information Center. Robert C. Kelly. June 1972. 57 pages.

TID–3522–Rev. 9—Sup. 1

This bibliography is comprised of 250 abstracts of articles and reports, all published during 1971, pertaining to the use of nuclear explosions for peaceful purposes. These potential applications include the excavation of harbors, canals, and mountain passes, production of trans-plutonium isotopes, neutron physics research, gas and oil recovery and storage, waste disposal, mining, and water management. Indexes are included, and the source where each report may be obtained is indicated.

◆

Power Sources

COOLING PONDS: A SURVEY OF THE STATE OF THE ART

Hanford Engineering Development Laboratory (AEC). J. C. Sonnichsen, Jr., S. L. Engstrom, D. C. Kolesar, and G. C. Bailey. September 1972. 111 pages.

HEDL–TME 72–101

The generation of electric power by a thermal station utilizing either fossil or nuclear fuel involves also the dissipation of waste heat by means of a water cooling system. The heated water produced in the process is either discharged to nearby watercourses or colored and returned to the system. A growing concern over environmental pollution had led to legislation restricting the use of natural water in this regard, making necessary the utilization of a cooling tower or pond. The report describes advantages and disadvantages of such a closed system, and is devoted principally to the mathematical, physical and economic aspects of various types of cooling ponds. A review is provided of pond volume and depth considerations, heat transfer, properties of water evaporation and circulation, and environmental aspects such as soil infiltration, fogging, and recreational use. The use of a spray pond is also discussed, and mathematical models are derived.

◆

SELECTED TECHNOLOGY FOR THE ELECTRIC POWER INDUSTRY

National Aeronautics and Space Administration Office of Technology Utilization. Walter T. Olson (Editor) 1968. 334 pages.

N69–12575

This document is comprised of papers which were presented at a conference, held at NASA's Lewis Research Center, which was intended to acquaint the electric power industry with relevant aspects of technology derived from aerospace research. The topics covered include: Nuclear reactor heat sources for future power generation: Rankine cycle power systems technology; Brayton cycle systems; reliability; automatic checkout and control; instrumentation; bearing and seal technology; engineering mechanics and materials; cryogenics and superconductivity; direct energy conversion.

◆

CONSIDERATIONS WITH RESPECT TO THE DESIGN OF SOLAR PHOTOVOLTAIC POWER SYSTEMS FOR TERRESTRIAL APPLICATIONS

California Institute of Technology. Paul A. Berman. June 1972. 18 pages.

N72–26034

Basically, the solar cell is a solid-state device which operates at ambient temperature and converts solar energy to electrical energy. These energy converters have been successfully employed in many space projects. Solar cell technology might well be the most significant sociological contribution of the space program, if it can be translated to terrestrial use. This report outlines what must be done to achieve significant improvements of the economics associated with fabrication of terrestrial solar photovoltaic arrays. Consideration is given to trade-offs, compromises, and optimization studies which must be performed in order to develop a viable terrestrial array system. Various approaches to cost reduction are presented, and the general requirements for materials and processes to be used are delineated.

◆

A SURVEY OF ALTERNATE METHODS FOR COOLING CONDENSER DISCHARGE WATER. TOTAL COMMUNITY CONSIDERATIONS IN THE UTILIZATION OF REJECTED HEAT

Dynatech R/D Company. N. Smith, and John S. Maulbetsch. November 1970. 62 pages.

PB–206 816

A SURVEY OF ALTERNATE METHODS FOR COOLING CONDENSER DISCHARGE WATER. OPERATING CHARACTERISTICS AND DESIGN CRITERIA

Dynatech R/D Company. Ware D. Fuller, and John S. Maulbetsch. August 1970. 100 pages.

PB–208 035

A SURVEY OF ALTERNATE METHODS FOR COOLING CONDENSER DISCHARGE WATER. LARGE-SCALE HEAT REJECTION EQUIPMENT

Dynatech R/D Company. John H. Carey, John T. Ganley, and John S. Maulbetsch. July 1969. 131 pages.

PB–208 036

A SURVEY OF ALTERNATE METHODS FOR COOLING CONDENSER DISCHARGE WATER. SYSTEM SELECTION, DESIGN, AND OPTIMIZATION

Dynatech R/D Company. N. Smith, and John S. Maulbetsch. January 1971. 114 pages.

PB–212 392

These reports provide a survey and analysis of alternate methods for cooling condenser discharge water from thermal power plants. PB-206 816 deals with the integration of the power plant with the community, with emphasis on the feasibility of using the waste heat in heating and air conditioning, aquaculture, process industry, sewage treatment, desalination, etc. The selection, design, and optimization of the power plant itself is dealt with in PB-208 035. PB-208 036 concerns various schemes for heat rejection on a large scale. Attention is given to the thermodynamic aspects of the steam power cycle, technical and operational considerations of the various types of heat rejection equipment, and methods of comparison and selection. Finally, PB-212 392 deals with the quantification of cooling system costs as a function of various parameters, the definition of the interface requirements between the power plant and the cooling system, and the optimization of the total power cost.

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THE WATER USE AND MANAGEMENT ASPECTS OF STEAM ELECTRIC POWER GENERATION

National Water Commission, Consulting Panel on Waste Heat. May 1972. 79 pages.

PB–210 355

In line with a growing concern for achieving a balance between developmental and environmental values, decision makers in water resource projects are considering the benefits and costs of alternative actions. One such question concerns the use of water for cooling in steam electric power generation plants, involving the problem of waste heat discharge to water bodies. Heat pollution is balanced against productive use of waste heat. The report discusses implications on both sides, along with the need to establish administrative policies. Some of the topics considered are siting for electrical energy plants, the potential for reducing waste heat, environmental effects of electric power plants, land resource planning, and technological development. Cost estimates are included.

CONSERVATION AND BETTER UTILIZATION OF ELECTRIC POWER BY MEANS OF THERMAL ENERGY STORAGE AND SOLAR HEATING

University of Pennsylvania, Towne School of Civil and Mechanical Engineering. Manfred Altman. October 1971. 265 pages.

PB–210 359

This document is concerned with the improved utilization of electric power, particularly with the use of thermal energy storage in comfort heating and air conditioning systems. The object is to satisfy climate conditioning needs by creating a system to utilize the energy or power at the time when it is available, convert it into heat, or coolness, store it, and use it when needed. Consideration is given to the utilization of solar heat as an energy source. Work has been performed on thermal energy storage materials, solar collectors, heating and cooling systems, modular components for industrially produced housing heating systems, electric generation system modeling, and consumer attitudes toward potential developments in thermal energy storage. A feasibility demonstration of the thermal energy storage air conditioning system was built and successfully tested.

MODELING AND OPTIMIZATION OF THERMAL POLLUTION CONTROL SYSTEMS

Kansas Water Resources Research Institute. Ching-Lai Hwang. August 1972. 51 pages.

PB–212 270

Although many industrial processes contribute waste heat to the environment, the most significant contributor is electrical power generating plants. There is an urgent need for gaining a better understanding of the effects of waste heat discharges; and there is also a need for designing improved discharge outfalls and finding optimal discharge policy for cooling water. This report describes the development of just such an optimal cooling water discharge policy of a power plant to a stream. The policy permits a plant to operate at the highest possible efficiency without violating a preassigned stream quality criterion. Also, a synopsis is given of the development of an optimal feedback control theory which can be

Power Sources
(continued)

applied in the optimal control of water quality control systems. Finally, the results of a study of the optimal management of a complex water quality control system are provided. The analysis procedure developed in this part of the report can be applied to designing new and examining existing water quality programs, and to the study of the influence of alternate policies and constraints.

Resource Surveys

THE APPLICATION OF GEOCHEMICAL, BOTANICAL, GEOPHYSICAL, AND REMOTE SENSING MINERAL PROSPECTING TECHNIQUES TO TROPICAL AREAS (STATE OF THE ART AND RESEARCH PRIORITIES)

Agency for International Development, Office of Science and Technology. November 1972. 80 pages.

PB–213 230

There is no geological reason why economic mineral deposits should not be present in the tropical regions of the world in the same relative abundance as elsewhere. One reason for their apparent lack is that many of the classical prospecting techniques have not proved nearly as effective as in the temperate and adjacent arid regions. In recent years a variety of promising new mineral prospecting techniques have been developed in the more technologically advanced countries; their potential application in the tropical environment, and the research needed to make them fully applicable, is the subject of this report. The general categories of technology considered include: geochemical prospecting, botanical prospecting, geophysical prospecting, and remote sensing. Descriptions are given of various instruments and survey methodologies and their principal applications; also approximate costs for basic instrumentation as well as for particular types of surveys are estimated. The report is based largely on report no. PB-207 191 (see AMTID, October 1972, page 76) and comments received on that report by numerous reviewers.

Safety

THE FIRE RETARDANCE EFFECTIVENESS OF HIGH MOLECULAR WEIGHT, HIGH OXYGEN CONTAINING INORGANIC ADDITIVES IN CELLULOSIC AND SYNTHETIC MATERIALS.

Stanford Research Institute. Anne E. Lipska. August 1972. 66 pages.

AD–750 773

Existing flame retardant treatments have certain shortcomings in that their durability is limited and their effect on appearance of the materials is considerable. This document provides the results of a study which sought to determine whether high-molecular-weight, inorganic additives, particularly those with high oxygen content are generally effective and potentially practical flame retardants in synthetic as well as natural polymers. The compounds investigated were first applied in their water-soluble forms and precipitated interstitially. It was found that cellulosic materials (alpha-cellulose, cotton, rayon, wood) with either phosphomolybdic, phosphotungstic acid, or ammonium phosphotungstate do not sustain flaming ignition when exposed to irradiances as high as 6.2 cal/sq cm/sec. Also, wooden stakes treated with either phosphotungstic acid or its ammonium salt exhibit greatly increased resistance to ignition and combustion when compared to untreated stakes. Further work is needed to fully evaluate this treatment, and also to optimize its use with polyester and nylon.

CHEMICAL AND PHYSICAL PROPERTIES AND THERMAL DECOMPOSITION PRODUCTS OF CERTAIN NATURAL PRODUCTS AND SYNTHETIC MATERIALS.

USAF Environmental Health Laboratory. Walter W. Melvin, Jr. May 1972. 170 pages.

AD–751 899

A review of the literature is provided on deaths, injuries, and costs resulting from the combustion and pyrolysis of resins, plastics, and natural products. Of primary concern is the application of these materials in wearing apparel, construction trades, the aircraft industry, etc. An extensive set of tables is included with provides such data as: Trade names of plastics, their type, and their manufacturer; flammability characteristics of plastics, plastics processing materials, natural and synthetic fibers, and other materials such as wood and paper; combustion and pyrolysis products of the above materials; and human physiological effects of various noxious gases. Also, results are given of some original research involving the determination of the flammability and pyrolysis of five types of carpeting materials.

OCCUPATIONAL EXPOSURE TO HOT ENVIRONMENTS. CRITERIA FOR A RECOMMENDED STANDARD

National Institute for Occupational Safety and Health. 1972. 112 pages.

PB–210 794

This document sets forth a series of recommendations pertaining to the exposure of workers to heat in the work-place. Adherence to the precautionary procedures will prevent acute or chronic heat disorders and illnesses and heat induced unsafe acts, and will reduce the risk of harmful effects due to the interactions between excessive heat and toxic chemicals and physical agents. The recommendations are amenable to techniques that are valid, reproducible, and presently available.

Safety
(continued)

JET BLAST HAZARDS

National Transportation Safety Board, Bureau of Aviation Safety. July 1972. 34 pages.

PB–211 593

This report provides a review of hazards directly related to the inadvertent use of jet thrust power and its adverse effects on other aircraft, airport-ramp personnel, passengers, and airport equipment. These jet-blast hazards are illustrated by a representative number of accidents and incidents. Charts and tables provide specific information on jet-blast vs. distance for the three-and-four-engine wide-body jet aircraft.

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A DESIGN GUIDE FOR HOME SAFETY

Teledyne Brown Engineering. January 1972. 156 pages.

PB–211 709

This manual is intended to provide planners, designers, architects, engineers, builders, and housing officials a guideline for use in their efforts toward creating a safe residential environment through conscious awareness of why accidents occur, for the development of comprehensive planning techniques, and stimulating safety-orientated practices. Included in the pages of the manual are (1) Statistical data on the causes of home accidents, (2) Comprehensive, well-illustrated design guideline and recommendations, including engineering rationale for the recommendations, and (3) A series of safety checklists pertinent to each major design considerated. The text is oriented primarily toward one- or two-family homes; however, much of the information may be applicable to components in multi-family dwellings as well.

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Soil Mechanics

STABILIZATION STUDIES OF SOUTHEAST ASIAN SOILS: VIETNAM

Construction Engineering Research Laboratory. Raymond E. Aufmuth. June 1972. 18 pages.

AD–745 901

A study was undertaken to determine the feasibility of stabilizing or otherwise improving selected engineering properties of six soils commonly encountered in construction operations in South Vietnam. The soil types involved were a decomposed granite, a recent alluvium, an ancient alluvium, two laterites, and a basalt. It was found that the addition of 5 to 9% lime or cement would stabilize five of the soils, resulting in significant changes in their engineering properties considered important in construction. The one exception was the recent alluvium; however, even with this soil, the addition of lime or cement improves all engineering properties except strength.

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STABILIZATION OF CONTAMINATED CLAYS

Construction Engineering Research Laboratory. Raymond E. Aufmuth. June 1972. 16 pages.

AD–745 902

An investigation was made of the effects of naturally occurring salts on the unconfined compressive strength of three basic clay minerals (kaolinite, illite, and montmorillonite) in their natural state, and stabilized with lime and cement. In general, sulfate and chloride salts were found to have adverse effects on natural clay minerals, resulting in lower compressive strengths. The existence of these salts in lime-treated clay minerals, however, results in strength increases. The salts impart an increased strength in cement-treated illite and kaolinite, but cement-montmorillonite-salt admixtures develop lower strengths than those of cement-treated montmorillonite alone. This study should help in the understanding of the probable effects of the unavoidable use of or presence of chloride or sulfate salts in clay construction bases.

SUMMARY OF COMPARISON OF ENGINEERING PROPERTIES OF SELECTED TEMPERATE AND TROPICAL SURFACE SOILS

Army Engineer Waterways Experiment Station. M. P. Meyer. January 1968. 26 pages.

AD–746 757

An appreciable amount of knowledge has been obtained on the physical characteristics of surface soils of temperate climates. This information has been used to identify the engineering properties of given soil types and to develop techniques for predicting those characteristics in soils which cannot be examined directly. However, relatively little work of this nature has been conducted on soils of tropical climates. This paper summarizes a study (reported in detail in AD—486 478; see AMTID, July 1972, page 66) of the engineering properties of 28 soils conducted to determine the degree of analogy between soils from temperate and tropical climates. The study shows the relation among physical properties of the soils and the horizontal variability of physical properties of temperate and tropical soils *in situ*.

THE EFFECTS OF MIXING CONDITIONS, METHOD OF COMPACTION, AND CURING CONDITIONS ON THE EFFECTIVE STRESS-STRENGTH BEHAVIOR OF A STABILIZED SOIL

Massachusetts Institute of Technology, Department of Civil Engineering. Anwar E. Z. Wissa, Ross T. McGillivray, and Jose Guillermo Paniagua. August 1971. 75 pages.

AD–747 351

Soil-cement is a tightly compacted mixture of soil, portland cement, and water which, as the cement hydrates, forms a hard durable structural material. The use of soil-cement as a construction material has increased since its conception in the 1930's until it is now the most common method of soil stabilization. It is also used in large quantitites for inexpensive roads in developing countries. There are a number of key factors which affect the structural properties of soil-cement, and this report concerns several of these. Specifically the effects of mixing conditions, curing procedure, and method of compaction on the strength behavior of cement-stabilized clayey silt were investigated using consolidated-undrained triaxial compression tests with pore pressure measurements. The testing procedures are described, and the results are described in detail.

PERFORMANCE EVALUATION OF CEMENT-STABILIZED SOIL LAYERS AND ITS RELATIONSHIP TO PAVEMENT DESIGN

University of California (Berkeley), Department of Civil Engineering. James K. Mitchell, Tzou-Shin Ueng, and Carl L. Monismith. August 1972. 177 pages.

AD–747 352

A series of four test sections of cement stabilized soils were constructed and trafficked under different wheel loads. The subgrade soil was a heavy clay, and the compacted surface layers of different thicknesses were a silty slay stabilized with 3%, 6%, or 10% by weight portland cement. The objective was to investigate the relation between the behavior of stabilized soil layers and their quality and thickness; and, also, to develop criteria and procedures for the design of pavements containing cement-stabilized soil layers. This report contains the results of the investigation. Among the findings are the following: Unconfined compressive strength can be used to correlate different cement-stabilized soil properties; performance correlated well with cement content, pavement thickness, subgrade strength, pavement strength, and traffic; prediction of stresses, deformations, and fatigue behavior in cement-stabilized soil pavements is possible using the finite element method and elastic layer theory; and the performance data enable the development of design curves for pavements containing cement-stabilized soil layers (design curves are presented for pavements similar to those of the test sections).

SMALL-SCALE MODELS FOR STUDYING EFFECTS OF CREEP AND SHRINKAGE ON LONG-TERM DEFLECTION OF REINFORCED CONCRETE SLABS

Army Engineer Waterways Experiment Station, Concrete Laboratory. F. B. Cox. July 1972. 82 pages.

AD–746 974

In recent years, the use of higher concrete and reinforcement stresses combined with harder, more brittle materials has resulted in slender, partially cracked, and more flexible structural members; thus the problems of deflection control and the prevention of deflection-induced cracking have become much more acute. A majority of the available methods for predicting the deformation of reinforced structures are essentially based on a short-term analysis with an arbitrary factor applied to this analysis for an estimation of the more important long-term deformations. This report gives the results of a study of the feasibility of using small-scale models to study the effects of creep and shrinkage on the long-term deformations of reinforced concrete slabs. Consideration is also given to (1) The smallest scale length that can be reliably used to study these effects; (2) The degree to which creep and shrinkage may affect the model slabs loaded with various combinations of static and dynamic loads; (3) The possibility of correlating creep and shrinkage measurements obtained from the model slabs with standard laboratory specimens.

FLEXURAL STRENGTH OF FERRO-CEMENT PANELS

Naval Civil Engineering Laboratory. J. E. Tancreto and H. H. Haynes. August 1972. 32 pages.

AD–748 582

Ferro-cement is a term used to denote a cementitious material reinforced with closely spaced multiple layers of steel wire mesh. The combination has been found to exhibit the properties of true composite materials rather than those of standard reinforced concrete. Ferro-cement lends itself to many marine and thin-shell construction applications, allowing a freedom of design unattainable with flat slabs and rectangular beams of reinforced concrete. The report covers a study of flexural loading to determine the first cracking, visible cracking, and ultimate strength properties of this material. Test structures included panels using chicken wire.

STATIC AND DYNAMIC SHEAR BEHAVIOR OF UNIFORMLY LOADED REINFORCED CONCRETE DEEP BEAMS

University of New Mexico, Eric H. Wang Civil Engineering Research Facility. Robert Crist. November 1971. 268 pages.

AD–890 311

In recent years there has been a growing need for knowledge of the behavior of deep reinforced structural members. Deep beams are occurring in structures more frequently than in the past because of required higher load-carrying capacities. Also, deep beams are now acknowledged, whereas in the past the short stubby beams (brackets, pile caps, bridge piers, etc.) were not recognized as deep members. This report is a result of work which was undertaken to derive methods of analysis for predicting shear capacities of these members. Behavioral equations were developed, and a series of static and dynamic beam tests were performed to provide data and verification. Equations for a total static shear capacity are given which conservatively predict shear capacities. Also equations for a total dynamic shear capacity for a first cycle loading are given which conservatively predict shear capacities.

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Transportation

THE CALCULATION OF AIRCRAFT COLLISION PROBABILITIES

Federal Aviation Administration. Juan F. Bellantoni. October 1971. 41 pages.

AD–744 722

A problem of increasing seriousness in air traffic control, as demand for air space grows in limited terminal facilities, is setting an adequate separation distance for aircraft in flight. Often the actual or proposed flight paths of two aircraft are such that the relative separation vector has no well-defined point of closest approach. A new system is needed for determining the quantitative relation between any prescribed set of flight paths and the risk of collision. The report extends a statistical probabilistic method of collision probability calculation heretofore used in parallel, straight line flight paths to arbitrary paths and vehicle shapes, applicable to curved landing approaches to parallel runways. Some special cases are discussed: Large relative velocity, non-zero and zero relative velocity, and spherical collision surfaces. Formulas are derived and presented.

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CHLORIDE AND WATER PERMEABILITY OF AUTOMOTIVE BRAKE HOSE

Army Coating and Chemical Laboratory. Jules B. Counts, and Robert G. Jamison. July 1972. 32 pages.

AD–748 083

Water pick-up in automotive brake systems is a matter of grave concern, since it increases vapor locking tendencies and affects viscosity. Permeability of brake hoses is an important factor in the entry of water into a brake system. This document provides the results of a study of the parameters of time, temperature, type of exposure, type of hose rubber, and type of brake fluid affecting the water permeability of automotive brake hoses. Also, since vehicles are sometimes required in the presence of fairly large concentrations of salts, data are provided on the permeability of chloride and the effects of chloride content on the stroking and storage properties of various brake fluids. In general, it was found that sufficient chloride and water can permeate brake hoses to initiate corrosion in brake systems; however, the extent of permeability is greatly reduced in systems containing silicone fluids.

PROTECTION OF TRANSPORTATION FACILITIES AGAINST EARTHQUAKES

National Transportation Safety Board, Bureau of Surface Transportation Safety. February 1972. 41 pages.

PB–210 270

This report is an examination of U.S. Goverment involvement in the earthquake problem, especially as it relates to transportation. Major elements of programs and existing design practices are discussed, and recommendations are made which should reduce the earthquake hazard to transportation facilities and the people who use them. Specific topics covered include: History of earthquakes in the U.S.; existing standards for earthquake-resistant design and construction of transportation systems; modification of existing transportation structures; cost/benefit studies in terms of risk to transportation structures; strong-motion seismic equipment; geodetic mapping; geological and seismic mapping; earthquake engineering research; earthquake study teams; emergency relief.

A DISAGGREGATED BEHAVIORAL MODEL OF URBAN TRAVEL DEMAND

Charles River Associates Incorporated. March 1972. 260 pages.

PB–210 515

The management and planning of urban passenger transportation requires data on the habits and preferences of the traveling public in addition to information on its makeup and geographic distribution. The use of mathematical models in the planning system has been found helpful. The report deals with the design and calibration of behavioral travel models, those which can express the relationships underlying travel decisions and which can be used to measure the effect of changes in transportation operations on travel patterns. Especial attention is given to the theory of transportation demand in explaining the decision making process of modal choice, developed at the household or individual tripmaker level. It is structured to incorporate trip generation, trip distribution, and modal split into a single model of urban demand. The theory was tested in one urban transportation setting, and the results are discussed.

STANDARDIZATION OF AUTOMOTIVE DIAGNOSTIC SYSTEMS

National Motor Vehicle Safety Advisory Council. July 1972. 429 pages.

PB–212 471

Automotive diagnostic systems may be possibly standardized for use in assembly line checkout, informing the driver, assisting mechanics, and providing instant evaluation for inspectors. This document is comprised of 22 papers concerning the subject, by authors from six countries, which were presented at the First International Congress on Automotive Safety. The specific subjects covered include: Automated diagnostic inspection systems; diagnostics as a systems concept; a concept for automated vehicle diagnostics; systematic application of diagnostic and test routines in automobile servicing; built-in test equipment; systems approach to automotive diagnostics; candidate automotive systems for diagnosis; wheel alignment inspection and its application in automated diagnostic systems; standardized approach to headlight aiming; vehicular diagnostic interconnections; economics of universal off-vehicle diagnostic techniques; vehicle testing techniques and operational safety; Chrysler's diagnostic testers; OK-Meter fault detection system for automobiles; vehicle emission sensor costs; the first automatic fault isolation testing system for reciprocating engines designed for production use; the transition from subjective to automated vehicle inspection and diagnosis; methods to achieve standardization of automotive diagnostic testing; diagnostic requirements for improved automotive safety and service; fitting automotive diagnostic systems into current socio-economics; off-vehicle automatic test equipment; implementing a program of automotive diagnostic analysis.

STEAM BUS SYMPOSIUM PROCEEDINGS

Scientific Analysis Corporation. November 1971. 88 pages.

PB–212 535

This document is comprised of papers presented at a symposium on the technology of using steam power in urban transit buses. The principal advantage of this type of bus is its relatively pollution-free operation. Included among the topics discussed are: The Urban Mass Transportation Administration steam bus development and demonstration program; the Environmental Protection Agency Rankine cycle propulsion system program; role of the California Legislature in steam bus development; combustor research and emission goals; and descriptions of steam buses developed by Steam Power Systems, William M. Brobeck and Associates, Lear Motors, and Vought Aeronautics.

Transportation
(continued)

TRANSPORTATION-ADVANCE PLANNING STUDY, VIETNAM

Louis Berger, Inc.; and Systems Associates, Inc. J. Fay, D. Sherman, C. Sauerbier, D. Howe, C. Troutman, and J. Price. October 1970. 402 pages.

PB–212 787

Significant resources have been invested in South Vietnam's transport system in recent years, most of which were made to assist the military. The transportation study which is the subject of this report is one of the efforts being made to examine the non-war-related investment requirements of Vietnam. An economic model and three computer programs are described which were used to depict South Vietnam's transport system. The computer programs compute minimum cost routes, least cost routing of commodities, the effect of fares and other factors on air and bus passenger traffic, and which road improvement projects are likely to result in maximum benefit/cost ratios. Consideration is given to the probable magnitude of investment funds available for transportation projects. Recommendations are made regarding the most economic transportation investment plan.

Water Supplies
and Hydrology

THE EFFECTS OF STRIP MINING UPON NAVIGABLE WATERS AND THEIR TRIBUTARIES: DISCUSSION AND SELECTED BIBLIOGRAPHY

University of Pittsburgh, Graduate Center for Public Works Administration. W. D. Brinckloe, W. Barber, D. Eaton, S. Alam, and D. Hitchcock. July 1972. 100 pages.

AD–749 802

Strip mining involves digging a series of parallel trenches or around a hillside for coal or other minerals. The extensive land disturbance, removal of vegetation, and exposure of toxic materials which are associated with strip mining frequently result in the pollution of surface waters and adverse changes in stream hydrology. The most significant adverse effects are change in runoff, increased sedimentation, and acid mine drainage. This document provides background information and a summary of available references on the effects of this form of mining on navigable rivers and their tributaries. The topics covered include: Description and scope of surface mining activities; effects on runoff, sedimentation, water chemistry, stream ecology, and water users; abatement of the adverse effects of strip mining by reclamation of mined areas and by treatment of mine drainage.

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT

University of California (Los Angeles). Glenn W. Graves, Andrew B. Whinston, and Gordon B. Hatfield. August 1970. 136 pages.

PB–195 830

EXTENSIONS OF MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT

University of California (Los Angeles). Glenn W. Graves. April 1972. 88 pages.

PB–212 008

These documents present a planning tool (algorithm) which will provide optimal solutions for the complex choices involved in balancing alternative methods for attaining regional water quality goals. The work encompasses three broad related areas. The first area is the social and economic question of what are desirable and feasible water quality goals and what is the best way to achieve and pay for them. The second area is the complex technical engineering problem of the physical response of the environment to various control strategies. The third area is the mathematical problem of obtaining least cost solutions in the total regional water system that will satisfy the desired goals. The contents of PB–195 830 include: Mathematical development; deprivation of the nonlinear problem; generation of the underlying array of the local linear program; development of treatment costs; economic considerations. PB–212 008 includes: Selection of a waste treatment plant configuration; transfer functions; estimation of the depth and velocity of a river for a given rate of flow; transient effects in an estuary; pollution taxes and charges in perspective.

THE ECONOMIC VALUE OF WATER: CONCEPTS AND EMPIRICAL ESTIMATES

Colorado State University, Department of Economics. Robert A. Young and S. Lee Gray. Mar. 1972. 347 pages.

PB–210 356

Water is classed as a renewable but fugitive resource which enters into a land-air hydrologic cycle and becomes available for use only during the land portion of the cycle. The document is concerned with the latter phase. Consideration is given to the evaluation of water resources and special problems encountered in such evaluation. Water valuing is discussed for crop irrigation, industrial operations, municipal uses, waste handling, fish and wildlife habitat, inland waterway navigation, and hydroelectric power generation. A number of issues are examined which must be considered in deriving conceptually valid estimates of these values. Previous studies are noted in a detailed literature review.

ECONOMIC VALUE OF WATER IN A SYSTEMS CONTEXT

Washington State University. Walter R. Butcher, Norman K. Whittesey, and John F. Orsborn. May 1972. 186 pages.

PB–210 357

Economists have contended that the management and use of water resources could be simplified by employing the knowledge of water value in alternative uses as a basis for allocations, particularly as a high degree of interaction exists. Water use at one point can result in natural system changes elsewhere, and since water is not consumed as other commodities but is returned to the system, coordination among the users can be effective. At the same time, pollution at one point may preclude uses somewhere else. The report illustrates how the interactions are important. Systems models are discussed as the most efficient approach to estimating values, using three different river systems for the data base. Cost benefit statistics are given for several categories of interest, including mine drainage, pollution abatement, supply, outdoor recreation, fish and wildlife habitat, flood damage reduction, and land conservation.

USE OF REACTOR COOLING WATER FROM NUCLEAR POWER PLANTS FOR IRRIGATION OF AGRICULTURAL CROPS

Oregon State University, Water Resources Research Institute. Larry L. Boersma, Edward W. R. Barlow, and Kenneth A. Rykbost. April 1972. 109 pages.

PB–210 747

The disposal of waste heat from nuclear electric power plants is of rising concern to environmental engineers, and ways are being sought to convert the energy from a hazard to a beneficial resource. One possibility is utilization of the warmed water from nuclear cooling systems for irrigation using a system of underground pipes. The document discusses the need for increased agricultural productivity to match the growth of population, and considers ways of determining what improvement has resulted from developed or innovative technology. Data from field tests are reported for warm water irrigation, including crop yields, materials and methods, soil properties, instrumentation, and favorable indications for the process.

CHANGES IN WATER QUALITY RESULTING FROM IMPOUNDMENT

Environmental Protection Agency, Robert S. Kerr Water Research Center. W. R. Duffer, and C. C. Harlin, Jr. September 1971. 103 pages.

PB–211 159

This report provides the results of studies which were undertaken to determine immediate changes in stream water quality resulting from construction of a reservoir and to establish critical factors in the reservoir responsible for quality changes. These quality relationships are important for predicting water quality within proposed reservoirs and in planning for flow augmentation for water quality control. The study is unique since the characteristics of the drainage basin combined with analytical procedures employed permit evalution of pollutional effects as well as other environmental variables. Other important features include an evaluation of water quality determinations during the transitional period while the reservoir is filling and a comparison of changes in tributary water quality with those occurring in the stream below the dam. Critical factors influencing water quality changes within the reservoir are identified by comparing changes in parameters with respect to season, year, station location, and depth of sampling.

A COMPUTER MODEL FOR PREDICTING NITRATE AND OTHER SOLUTES OF AGRICULTURAL DRAIN WATER

University of Arizona, Department of Soils, Water and Engineering. Gordon R. Dutt, and Marvin J. Shaffer. June 1972. 29 pages.

PB–211 214

The use of mathematical models has been increasing in surface water management for studying the properties of hydrologic cycles. A system of particular interest is the tile drained area over an impervious stratum. Considerable research has been devoted to predicting the movement of agricultural water from the surface to tile drains, but the effect of highly soluble salts which react chemically with the soil material needs more attention. Since water quality criteria depend upon the concentrations of such solutes, a predictive procedure has been sought which considers their interactions. The report deals with such a procedure. For purposes of modeling the system has been divided into an unsaturated flow region and a saturated flow region. A computerized simulation model is presented for several ionic species of solutions, including chloride, ammonium, sulfate, bicarbonate, carbonate, calcium, magnesium, and sodium. A procedure is outlined for utilizing the models with others previously developed. It is expected that the procedure can be applied to base saturated soils and other soils. The computer program listing is included.

IDENTIFICATION AND MEASUREMENT OF QUALITY OF LIFE ELEMENTS IN PLANNING FOR WATER RESOURCES DEVELOPMENT: AN EXPLORATORY STUDY

Utah State University, Institute for Social Science Research on Natural Resources. Wade H. Andrews. Apr. 1972. 184 pages.

PB–211 220

It is assumed that development of the water resources in an arid region will improve the quality of life of the population. Achieving a good life includes reducing hazards and risks to health and safety, increasing comforts and leisure time and freedom of choice of activities. It has been the aim of the study to explore the benefits and costs of the elements contributing to the quality of life of people located in a water development area. A report is made on objectives and various problems encountered, the methods of data collection, and the types of analysis used. Some of the elements affecting social well being are flooding and lack of water, the political scene, esthetics, income redistribution, irrigation applications, recreation, economic stability, educational factors, public opinion, benefit-cost perception, and group response.

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PROCEEDINGS—URBAN RAINFALL MANAGEMENT PROBLEMS (RUNOFF, SEDIMENT, SANITARY LANDFILL)

University of Kentucky, College of Engineering. June 1972. 176 pages.

PB–211 271

This document is comprised of papers which were presented at a short course on certain aspects of urban meteorology for scientists and engineers. Some of the topics covered include: The urban climate; theory and prediction of rainfall and runoff in urban areas; erosion sediment production; practical alternatives to urban erosion; characteristics of a sanitary landfill and its potential effects on water quality; principles of water movement in sanitary landfills; pollution attenuation by soils; summary of sanitary landfill technology.

* * *

THE USE OF DETAILED SOILS INFORMATION FOR DELINEATING AND REGULATING FLOOD PLAINS: LEGAL AND ADMINISTRATIVE CONSIDERATIONS

University of Wisconsin, Water Resources Center. Douglas A. Yanggen. 1972. 77 pages.

PB–211 324

Periodic inundation of the flood plains of rivers and streams is a natural occurrence by which large flows from heavy rainfall or snowmelt are carried away, but this action results in damage to the constructions and developments of man. For this reason much public works construction is devoted to the prevention and reduction of flood losses in damage prone areas. Since these measures do not eliminate periodic floodings, the alternatives of regulation and land use controls must be employed, so that extension of streets, water, sewer, and other public facilities is limited in flood hazard areas. The first step in such limitation is the identification and delineation of the areas subject to inundation. Soils information can be used for this purpose, utilizing soil survey maps, although it is not possible to determine flood frequency. Engineering studies of flooding in certain areas can be extrapolated to other areas, and ordinances can be drawn up on the basis of this information. A discussion is made of the methodology and legal considerations in the process.

DEVELOPMENT OF NEW TECHNIQUES FOR DELINEATION OF FLOOD PLAIN HAZARD ZONES: DETAILED SOIL SURVEYS, AND AIR-PHOTO INTERPRETATION

University of Wisconsin, Water Resources Center. Gerhard B. Lee, Dale E. Parker, and Clarence J. Milfred. 1972. 102 pages.

PB–211 325

A basic need in flood plain management is to identify and delineate regions subject to inundation. Flood hazard areas usually have been studied by reviewing records of past floods and by hydrologic and hydraulic analysis, both of which approaches involve engineering studies costly to obtain and not available in every case. The objective of the investigation reported is to determine whether flood hazard zones might be delineated for planning and regulation by the interpretation of detailed soil maps. The study considers the physiographic flood plain and the processes by which a river channel flows and floods. A review of the literature is made, with a description of engineering methods and the use of soil maps by which a flood plain is delineated. Six regions are discussed, including the Mississippi and three other rivers, and two creek locations. A summary of the methodology is followed by some conclusions, particularly with regard to air photos and remote sensing.

SUBSURFACE WATER POLLUTION. A SELECTIVE ANNOTATED BIBLIOGRAPHY. PART 1. SUBSURFACE WASTE INJECTION

Environmental Protection Agency, Office of Water Programs; and Water Resources Scientific Information Center. March 1972. 164 pages.

PB–211 340

SUBSURFACE WATER POLLUTION. A SELECTIVE ANNOTATED BIBLIOGRAPHY. PART II. SALINE WATER INTRUSION

Environmental Protection Agency, Office of Water Programs; and Water Resources Scientific Information Center. March 1972. 168 pages.

PB–211 341

SUBSURFACE WATER POLLUTION. A SELECTIVE ANNOTATED BIBLIOGRAPHY. PART III. PERCOLATION FROM SURFACE SOURCES

Environmental Protection Agency, Office of Water Programs; and Water Resources Scientific Information Center. March 1972. 170 pages.

PB–211 342

The concept of irreversibility in ground water pollution is widely accepted. Once an aquifer has been contaminated, it is difficult or infeasible to flush or pump out the contaminants and restore the aquifer to its original quality. This bibliography deals with three distinct categories of ground water pollution: Part I concerns pollution associated with the deliberate injection of wastes below the water table; Part II concerns pollution associated with the intrusion of saline waters into fresh water aquifers; and Part III concerns pollution associated with the percolation of wastes from surface sources. In each part, abstracts are provided of publications dealing with the prevention of abatement of pollution, litigation pertaining to incidences of pollution, and laws and regulations pertaining to the construction and operation of subsurface waste disposal facilities. Indexes are included.

URBAN WATER PLANNING: A BIBLIOGRAPHY

Water Resources Scientific Information Center. George F. Mangan, and Herbert A. Swenson. July 1972. 375 pages.

PB–211 553

This document contains about 250 abstracts of the literature pertaining to the planning of urban water resources. Some of the topics covered include: Benefit-cost analysis; river basin and lake projects; community, city, and regional planning; computer and mathematical models; economic and environmental factors; flood control; storm engineering; waste water treatment; water pollution; reservoirs; supply and demand considerations; and recreation. Subject and author indexes are included.

SEDIMENTATION AND CONTAMINANT CRITERIA FOR WATERSHED PLANNING AND MANAGEMENT

Colorado State University, Environmental Resources Center. Hsieh W. Shen. June 1972. 184 pages.

PB–211 665

With a growing demand for watershed sediment control, there is need to obtain more information on the mechanics of overland sheet flow. Tree removal in large scale logging operations has resulted in serious sedimentation problems, some of which may be solved by utilization of tall vegetation to reduce sediment transport. The effect of rainfall on stream transport of sediment is also receiving attention, since rain on a stream surface reduces stream velocity, affecting in turn the transport properties. Of particular concern is the attachment of contaminates such as herbicides, pesticides, and radioisotopes to the sediment particles. A report is made on the hydrodynamics of vegetation, using simulation models of vegetation stalks, and giving the results of tests on the resistance of vegetation to flow and the sediment yield rates for various conditions. The effect of rainfall on sheet flow is discussed, followed by observations on the dispersion of contaminants attached to the top soil. The latter two treatments are largely mathematical, with some laboratory test results included.

A SURVEY OF INDEXING AND ABSTRACTING SERVICES FOR WATER RESOURCES ENGINEERING

University of Maryland, Water Resources Research Center. Hans Wellisch. 1972. 100 pages.

PB–211 913

Water resources engineering is a relatively recent term for the activities of scientists and engineers engaged in the exploration of water resources, their utilization, and their conservation. Workers in this field are confronted not only with a bewildering variety of primary literature sources—periodicals, reports, monographs, theses, conference papers, etc.—but also with a great many secondary services which try to control the flood of information about water resources, each one in different subfields and from varying points of view. In this survey, a large number of abstracting and indexing services from all over the world are compared and evaluated, for the purpose of determining whether existing services are adequate in number, quality and coverage, and where the coverage is inadequate as to scope, quality, language area, or level of presentation. The criteria of standardization of data elements and of compatability of products are also considered. Finally, an effort is made to assist users of the literature in this field—scientists and engineers as well as librarians and documentalists—to choose among the many services those which most nearly cover their particular interests in terms of national and international coverage and also with regard to subject specialization.

THE ECONOMIC VALUE OF WATER QUALITY

Metcalf and Eddy, Engineers. January 1972. 241 pages.

PB–212 126

As the populations of the world continue to grow, particularly in urban areas, the need for adequate water supplies becomes increasingly important. Previously untapped sources of water must be utilized to augment the fresh water supplies available locally. In order to judge the relative economy of each source of water supply for any location, the true costs of alternative water supplies must be determined. These true costs include not only the costs for water supply development, transmission, and treatment, but also "user costs", the costs to the customer incurred through the use of the water. In areas where highly mineralized water is used, for example, the user cost may include maintenance and repair due to scaling and corrosion, special treatment such as softening or demineralization, or the cost of chemical agents to combat high hardness. This report gives the results of an effort to determine the costs to domestic, industrial, and commercial water users incurred by the use of the water. Such information may, when related to the mineral constituants in the water, be used to determine user costs for any water quality and to predict how these costs would change if the mineral content were changed by treatment or demineralization.

POPULATION DYNAMICS OF WORLD FISHERIES

University of Washington, Division of Marine Resources. John A. Gulland. May 1972. 348 pages.

COM–72–10812

This document is comprised of a series of papers, the overall purpose of which is threefold: To describe some of the world's major fisheries; to review some of the techniques used in fish population dynamics; and to demonstrate how the theory of fish population dynamics can be applied to real fisheries. In particular, an examination is made of how this application can help the people dealing with these fisheries—the fishermen, the fishing industries, the administrators, and the governments—to solve their problems. Introductory material deals with a general description of world fisheries and the relevance of population dynamics to present-day problems. Succeeding chapters concern specific fisheries, the application of particular methods in population dynamics to these fisheries, and the provision of advice to fishing industries about what is happening to the fisheries and what may be done to improve matters. The fisheries involved include yellowfin tuna, North Sea plaice, cod, herring, whales, harp seals, and Peruvian anchovy. In addition, a special analysis is provided of the Gulf of Thailand trawling fishery, and of the problems of the fisheries off West Africa. Finally, a discussion is provided of the future of world fisheries and new demands of population dynamics.

SEAFOOD QUALITY CONTROL. BOATS AND FISH HOUSES.

Texas A and M University. Ranzell Nickelson, II. April 1972. 9 pages.

COM–72–11227

This document is designed to familiarize the boat and fish house operator or employee with factors affecting seafood quality in daily operations. Included is information on bacteria in relation to spoilage and on the various factors affecting seafood quality at each step of the harvesting and handling procedures. Particular attention is given to sanitation on boats and in houses where handling procedures are conducted.

AN OPTIMUM TRAWLER FOR GROUNDFISH: DESIGN STUDY

Ocean Research Corporation. Cyrus Hamlin. January 1971. 123 pages.

COM–72–11298

Two major problems face a study of fishing vessels: The great number of variables involved, and the fact that fishing is essentially a hunting operation—far from being an exact science in its present state. Taking into consideration the biological and environmental aspects of the fish resources and the methods of finding, harvesting, and processing the fish, fishing vessel design must be evaluated relative to productivity, and to construction, operation, and maintenance costs. This report describes a method which may be used for optimizing the design of a fishing vessel for a particular fishery, which takes into consideration variables such as those mentioned above. Although the novel method was developed specifically for the design of groundfish vessels for use in the Northwest Atlantic, it is felt that it may be of value to those engaged in designing vessels for other trawl fisheries.

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Food Technology

STUDY OF A NONDESTRUCTIVE TEST FOR DETERMINING THE VOLUME OF AIR IN FLEXIBLE FOOD PACKAGES

Army Natick Laboratory, General Equipment and Packaging Laboratory. Jonathan Shappee, and Stanley J. Werkajski. June 1972. 31 pages.

AD–748 096

Flexible packages are challenging the traditional metal container as a means of preserving and storing processed foodstuffs. One aspect of packaging foods in flexible containers is the control of the amount of air or other gases in the sealed package. Current methods for sampling air in flexible packages result in the destruction of the package and the contamination of the food contained therein. This report describes a nondestructive method of determining the air content in flexible packages which is repeatable and correlates well with determinations made by destructive methods. The new method reduces the over-all test time and has the potential for cost savings. Furthermore, it does not require the use of highly skilled technical personnel or elaborate test apparatus.

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RELIABILITY OF FLEXIBLE PACKAGING FOR THERMOPROCESSED FOOD UNDER PRODUCTION CONDITIONS. PHASE I: FEASIBILITY

Swift and Company, Research and Development Center; Pillsbury Company; Continental Can Company; FMC Corporation; and Riegel Paper Corporation. D. D. Duxbury, P. F. Sams, W. F. Howeler, J. H. Gee, and W. N. Miller. July 1970. 248 pages.

AD–750 770

Previous research and development has indicated that the use of laminated, flexible packaging materials in place of rigid, tin-coated steel cans to hermetically package thermoprocessed shelf stable foods is technically feasible. During processing, the shape of the package permits packaging a wide variety of foods and, because of the shorter processing time, provides products of improved quality. Such packages also have a number of handling and storage advantages. This document provides the results of an effort to establish that thermoprocessed foods in flexible packages can be reliably prepared under production-type conditions. The technical feasibility of pouch forming, filling, vacuum sealing, and processing was established. Proposed product guideline formulas were revised to meet commercial production requirements. Also, quality assurance testing methodology was established.

ENGINEERING MODEL FOR FISH PROTEIN CONCENTRATION PROCESSES

National Marine Fisheries Service; and University of Maryland, Department of Chemical Engineering. K. K. Almenas, L. C. Durilla, F. D. Ernst, J. W. Gentry, M. B. Hale, and J. M. Marchello. October 1972. 182 pages.

COM–73–50021

Fish protein concentrate (FPC) production holds substantial promise of helping to meet the growing food and dietary requirements for the world's human population. It appears that several of the processes now being developed will be successful in making FPC available on a competitive basis with other sources of protein. To provide for the orderly and rapid development of these processes it is necessary to continually review the internal steps of each process and to compare processes on a common basis. This document describes a process engineering economic model which will serve as an aid in the accomplishment of this task. The model predicts the construction and operating costs for fish meal plants and for plants producing FPC by: isopropyl alcohol extraction, press cake/biological process, and press cake/isopropyl alcohol extraction. Typical process flow sheets and a computer program listing are provided for use in the design and cost computations.

THE SYNTHESIS OF STARCH FROM CARBON DIOXIDE USING INSOLUBILIZED STABILIZED ENZYMES

University of California, Lawrence Berkeley Laboratory. James A. Bassham, Lydia Bearden, Charles Wilke, Paul Carroad, George Mitra, and Richard Ige. June 1972. 85 pages.

N72–26103

The practical abiological syntheses of carbohydrates from carbon dioxide and water in a factory is a reality that still lies in the future. However, the spectre of widespread food shortages due to the increasing population, or perhaps to some sort of ecological collapse, provides ample motivation for undertaking long-range research efforts which may lead to the artificial manufacture of starch. This report first considers the synthesis of starch from carbon dioxide as a possible alternative to intensive agriculture. There then follows a discussion of the enzyme-catalyzed routes available and choice as to the most promising route. Consideration is given to the enzymes involved, to enzyme insolubilization technology, and of possible engineering approaches, with examples in the form of model calculations for both reactors and separators. Finally, there is a section on some other problem areas.

DEVELOPMENT OF A SCIENTIFIC BASIS FOR THE MANUFACTURE OF LOW-COST PROTEIN FOODS AND BEVERAGES FROM FRESH COCONUTS

Texas A and M University. Karl F. Mattil. September 1970. 77 pages.

PB–213 594

Coconuts represent a potential new indigenous protein source in the coconut producing countries of the world. This report provides the results of an effort to generate fundamental scientific and technological information basic to the practical exploitation of this protein source, and to evaluate the state of the art of processing fresh coconuts for food use. The evaluation is based on both a survey of the literature and personal contacts with those involved with research and development efforts. Results of basic investigations in the following areas are reported: The ultrastructure of coconut meats; physical processing methods for maximum extraction of fat and protein; the amount of heat treatment coconut meat and meal can tolerate without adverse effects on product quality; identification of major classes of protein in coconut meats; characteristics of each class of protein.

A SELECTED BIBLIOGRAPHY ON AFRICAN FOODS AND NUTRITION ARRANGED ACCORDING TO SUBJECT MATTER AND AREA

U.S. Department of Health, Education, and Welfare; and Food and Agriculture Organization of the United Nations. Woot-Tsuen Wu Leung, and Ritva Rauanheimo Butrum. December 1970. 391 pages.

PB–213 612

This bibliography is comprised of references to the world's literature, published in the 1940–1969 time period, dealing with the subject of food and nutrition in Africa. The entries are arranged by country and, within each country, according to general subject (general studies, food resources, food composition, food supplements, food technology, food habits, nutrition and dietary surveys, nutritional status, and nutrition education). A selected bibliography on African botanical nomenclature is appended.

IMPROVING THE NUTRITIVE VALUE OF CEREAL BASED FOODS. REPORT 3.

Kansas State University, Food and Feed Grain Institute. June 1971. 217 pages.

PB–213 756

This document describes the activities and accomplishments of an ongoing project which has as its overall objective the improvement of the nutritional value of cereal-based food in North Africa and Pakistan by supplementation and process modification without decreasing the food acceptability to the general consuming public in those areas. Research effort focused on the use of three protein sources: soy flour, chick-pea flour, and horse bean flour. These were used for food fortification. Emphasis was given to the nutritional and organoleptic evaluations of chapatis, couscous, and Moroccan bread fortified with the high protein flours.

IMPROVING THE NUTRITIVE VALUE OF CEREAL BASED FOODS. REPORT 4.

Kansas State University, Food and Feed Grain Institute. William J. Hoover, June 1972. 37 pages.

PB–213 769

A review is presented of research to improve the nutritional value of cereal based foods in North Africa and Pakistan by supplementation and process modification without decreasing the food acceptability to the consumers in those areas. The foods considered were protein fortified wheat based bread, chapatis, and coucous using soy flour, chickpea flour, and broadbean flour. The fortified foods met the nutritive guidelines established by the project and proved acceptable to small consumer panels. Many other protein resource materials were evaluated. A system of developing and evaluating protein fortified foods was evolved.

DEVELOPMENT OF SOY-BASED FOODS OF HIGH NUTRITIVE VALUE FOR USE IN THE PHILIPPINES

Cornell University, New York State Agricultural Experiment Station. W. B. Robinson, M. C. Bourne, and K. H. Steinkraus. January 1971. 106 pages.

PB–213 758

Results are provided of a research program which was undertaken to develop processes for manufacturing soy-based foods on a scale and of a simplicity appropriate to the socio-economic requirements of relatively small population centers in countries such as the Philippines. Flavor, acceptability, economy, and nutritional value were of primary concern. The report describes research conducted in the following areas: Development of a simple procedure for manufacture of a bland soy beverage and other products that could be easily produced without the use of elaborate and expensive equipment; introduction of the soy beverage to selected groups of Philippine school children: engineering studies on unit operations in soy product manufacturing; nutritional evaluation of the products and the nutritional effects of the unit processes involved; basic laboratory research on physical and chemical qualities of soy products and components to lay a scientific basis for improvement of the products and unit processes involved in their manufacture.

IMPROVING THE NUTRIENT QUALITY OF CEREALS. REPORT OF WORKSHOP ON BREEDING AND FORTIFICATION

Agency for International Development, Office of Nutrition; and Department of Agriculture, Foreign Economic Development Service. June 1971. 113 pages.

PB–213 764

There is a great potential for effecting improvement in diet through the breeding of higher protein content and quality in staples and through fortification of such staples during the milling process. The report presents papers from a Seminar on Breeding and Fortification held at Annapolis, Maryland from December 7-9, 1970. The papers concern progress, problems and potential for the improvement of various crops, including wheat, rice, corn, sorghum and millet. Recommendations are given for future operations and research.

THE FOOD INDUSTRY IN ASIA—ITS POTENTIAL FOR PROVIDING LOW COST NUTRITIOUS FOODS. SINGAPORE WORKSHOP, NOVEMBER 1-5, 1971. SUMMARY REPORT.

League for International Food Education. November 1971. 25 pages.

PB–213 766

The Singapore Workshop was convened to provide a forum where Asian private food industry businessmen could discuss the potential of the food industry for providing low cost nutritious foods. This report summarizes the discussions of these businessmen during the week-long meeting. Special emphasis is given to the constraints which were identified as being the ones which hinder the progress of low-cost nutritious foods. Equivalent emphasis is given to the recommendations for action which the participants felt could help overcome these constraints.

———o———

EXTENDING PROTEIN CONCENTRATES FOR CHILD FEEDING BY ADDITION OF INEXPENSIVE SIMPLE NITROGEN SOURCES

Massachusetts Institute of Technology, Department of Nutrition and Food Science. Nevin S. Scrimshaw. October 1971. 63 pages.

PB–213 787

A series of studies has been undertaken to determine the extent to which the concentration of essential amino acids in dried skim milk can be extended by the addition of non-specific nitrogen without influencing the nutritional value of the protein. The results of the studies, which were conducted in children and young men, are summarized in this report. The non-specific nitrogen source used was a mixture of glycine and diammonium citrate. The results support the conclusion that at any time that it is necessary to extend the "protein" content of milk supplies for the supplementary feeding of population groups, inexpensive non-specific nitrogen sources may be used to an extent of at least 10% without impairing the ability of the milk to meet any normal protein needs.

———o———

REPORT ON PROTEIN FOOD DEVELOPMENT PROJECT, 1969-1971.

Kasetsart University, Institute for Food Research and Product Development; and Thailand Ministry of Public Health, Health Department, Nutrition Division. Amara Bhumiratana, and Amorn Nondasuta. 1971. 307 pages.

PB–213 794

This document reports the activities and accomplishments of a project which was instituted to improve the nutritional conditions in Thailand. The principal objectives were: To promote development in food technology and related fields; to develop high-protein

Food Technology
(continued)

food supplements for infants and preschool children; to test new products for suitability and acceptability by consumers; and to promote new products on a commercial scale in an effort to increase consumption among the people. The information provided includes: The results of field trials of protein food prototypes; chemical and biological assays; flowcharts for the production of various protein foods; protein food promotion efforts; protein-enriched menus for school children, including recipes for their preparation. (Note: Bilingual text in English and Thai.)

* * *

Industrial and General Economic Development

TECHNICAL COOPERATION WITH IRAN. A CASE STUDY OF OPPORTUNITIES AND POLICY IMPLICATIONS FOR THE UNITED STATES

Agency for International Development. L. M. Branscomb, E. L. Brady, W. S. Butcher, M. D. Kilbridge, A. H. Moseman, J. A. Rienemund, E. R. Johns, C. T. Wood, and H. G. Buller, April 1972. 112 pages.

PB–212 397

There is a growing interest in the U. S. International Development community in establishing programs of technical cooperation with countries which are no longer eligible for A.I.D. Concessional assistance and, also, certain countries which have never received A.I.D. assistance. This document is the report of a team of specialists which undertook to explore the possibilities of implementing such a program with Iran. A brief review is provided of past U. S.-Iran technical cooperation activities, and areas for expanded cooperation are identified. Among the latter are the areas of agriculture, especially increased protein production; mineral exploration and development; and science and education, including the exchange of professionals and students. Various recommendations are made for follow-up by various U. S. agencies, and for strengthening and A.I.D. capabilities to assist Iran and other countries in a similar development status.

* * *

INDUSTRIAL DEVELOPMENT AND FEASIBILITY STUDY. PULP AND PAPER MANUFACTURING IN SOUTH VIETNAM. BOOK I

Thomas H. Miner, and Associates, Incorporated. April 1970. 382 pages.

PB–212 632

Vietnam has a variety of fiber resources which in total constitute an adequate raw material for pulp and paper industry. The present paper industry has been built with only the domestic market in mind, and currently it is entirely dependent on import of pulp. Under these circumstances of small size and imported raw material, the paper industry in Vietnam suffers from high costs. This study examines the feasibility of developing a viable pulp and paper industry in Vietnam in the early post-war period. The scope of the study includes: A review of the existing industry, including facilities, capacities, capabilities, and cost factors; a survey of present and possible future markets, both domestic and in neighboring Southeast Asian countries; a survey of indigenous fibrous raw materials, including types, amounts available, location, and cost; a proposal of location, number, type, and capacity of new facilities; and a calculation of grade costs, net realization, and financial soundness of the proposed facilities.

INDUSTRIAL DEVELOPMENT AND FEASIBILITY STUDY. PULP AND PAPER MANUFACTURING IN SOUTH VIETNAM. BOOK II

Thomas H. Miner and Associates, Incorporated. April 1970. 310 pages.

PB–212 633

This volume is comprised of appendices intended to accompany Book I of this study. The topics covered include: Marketing prospects for export; raw materials for a proposed kraft mill near Dalat; methods, equipment, and estimated costs for bamboo extraction at Phuoc Binh; summary of U. S. Forest Products Laboratory tests; materials, supplies, and unit costs; summary of corporate taxation and exemptions; core making plant; bamboo harvesting report; bagasse report; 250 ton integrated kraft mill.

FORESTRY IN DEVELOPING COUNTRIES. POTENTIALS, CONSTRAINTS, AND OPPORTUNITIES (PRELIMINARY SURVEY)

Agency for International Development, Office of Science and Technology. Gordon D. Fox. October 1972. 80 pages.

PB–212 726

The amount of land covered by forests in individual developing countries ranges from less than one percent to well over 75 percent. This report concerns the use of this renewable resource, with emphasis on economic development of forests under rational management practices. Specifically, the analysis is addressed to the following issues: The principal factors inhibiting better management and utilization of timber resources in tropical regions; the character and significance of these inhibiting factors; practical steps that might be taken to overcome these technical problems; and the likely impact on timber resources and their utilization if such steps were taken.

THE ROLE OF THE INDUSTRIAL SECTOR IN KOREA'S TRANSITION TO ECONOMIC MATURITY

Yale University, Economic Growth Center. Gustav Ranis. October 1971. 37 pages.

PB–212 748

Korea belongs to the category of developing country which have small, therefore open, labor surplus dualistic economics, characterized by a relative lack of natural resources and an abundance of unskilled labor at the outset. This paper begins with a definition of the "ideal" growth pattern for this type of economy. A review is then provided of the actual Korean experience relative to this ideal. Korean performance in this respect is contrasted to two other countries belonging to the same family; i.e. Japan, historically, and Taiwan in the post-war period. Consideration is given to the initial conditions and to the similarities and differences of the transition processes in the countries. Finally, the implications of this analysis with respect to further research and policy are discussed.

EQUITABLE DISTRIBUTION OF BENEFITS IN INTEGRATION SCHEMES AMONG THE LESS DEVELOPED COUNTRIES: THE ANDEAN GROUP

Harvard University, Center for International Affairs. David Morawetz. April 1972. 67 pages.

PB–212 749

All economic integration schemes among less developed countries which have been established to date have foundered on the problem of how to equitably distribute the benefits arising from the existence of the scheme. The Cartagena Agreement of the Andean Group customs union (Bolivia, Chile, Colombia, Ecuador, and Peru) includes several measures bearing on this problem. This paper provides a theoretical analysis of the benefit distribution problem, and an evaluation of the benefit distribution provisions of the Cartagena Agreement. Consideration is given to the definition of an "equitable" benefit distribution, some problems in measuring net benefits, and the presumptions as to whether benefits are likely to be equally or unequally distributed in integration schemes. A number of schemes which have been proposed and/or adopted to achieve equitable benefit distribution are then examined from a theoretical viewpoint. The measures contained in the Cartagena Agreement are analyzed in the light of this examination, and of the experience of other integration schemes with the benefit distribution problem.

AN EVALUATION OF RECENT PRIVATE INDUSTRIAL DEVELOPMENT IN NICARAGUA

Robert R. Nathan Associates, Incorporated. January 1971. 108 pages.

PB–212 779

In the mid-1960's, the Agency for International Development decided that the Nicaraguan industrial sector needed access to investment capital to finance a backlog of projects. AID met this need by making $17 million available to create and strengthen intermediate credit institutions to mobilize capital, both foreign and domestic. This report provides an assessment of the efficacy of the AID programs to the private industrial sector of Nicaragua and suggests changes that might improve them. Specifically, consideration is given to the following: Past rate of growth; prospects for industry in Nicaragua; strategic factors in industrial expansion; shortage for working capital and the debt/equity problems; cost of AID capital; investment climate in the industrial sector; AID contribution to meeting long-term capital needs; strengthening the capacity of the National Development Institute (INFONAC); creation of a new private investment bank; AID loan program as a stimulant to domestic savings; loans to small businesses and artisans; providing technical assistance; performance and impact of the industrial sector in recent years.

A FIRSTHAND STUDY OF INDUSTRIAL MANAGEMENT AND ECONOMIC DEVELOPMENT IN INDIA

Agency for International Development, Office of Program and Policy Coordination. B. Richman. December 1969. 368 pages.

PB–212 784

This document represents an effort to develop guidelines that can serve as a basis for effective action by managements of individual Indian enterprises in their attempts to adapt to and reduce the impact of negative environmental conditions on their performance. It also seeks to determine the extent to which managerial practices, techniques, concepts, policies, principles, and general know-how which tend to be effective on a relatively widespread scale in U. S. industry can be transferred and/or applied successfully to a developing country such as India. Consideration is given to the costs and benefits involved in the transference process, and to the degree that the Indian environment seriously constrains or prevents such transference. In addition, attention is given to the development of guidelines and meaningful priorities that indicate what action might best be taken by public authorities in dealing with environmental constraints which seriously hinder managerial performance and productive efficiency at industrial enterprises.

COSTS OF URBAN INFRASTRUCTURE FOR INDUSTRY AS RELATED TO CITY SIZE IN DEVELOPING COUNTRIES

Stanford Research Institute; School of Planning and Architecture (New Delhi); and Small Industry Extension Training Institute (Hyderabad). Om Prakash Mathur, Richard Morse, and M. C. K. Swamy. October 1968. 446 pages.

PB–212 916

The extent and kind of industrialization that are desirable in cities of different size have been debated in both developed and developing countries. There has been a dearth of information, however, on the relative costs and benefits of alternative strategies. This document provides the details of a study which was designed to measure the direct costs of equipping cities of different size for industrial development, including the costs of social infrastructure for new urban industrial employees and their families. It is orientated primarily to the situation in developing economies and is centered on the industrial growth requirements of selected cities in the states of Punjab, Haryana, and Uttar Pradesh, in northern India. An examination is made of the widely held belief that unit costs of incremental infrastructure for new industry tend to be relatively high in smaller cities, to decrease over some intermediate range of city sizes, and to rise significantly beyond some large city size. Consideration is given to both the effect of city size on costs, and to the combined effect of costs when composition of industry varies with city size. An annotated bibliography of over 150 entries is included.

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INTRODUCTION

Application of Modern Technologies to International Development is a new publication series sponsored jointly by the Agency for International Development and the National Technical Information Service (NTIS), United States Department of Commerce. The purpose of the series is to increase the ready availability of U.S. technical publications of special interest in developing countries to scientists, engineers, and planners in industrial and technological research institutions, universities, and government agencies to foster the transfer of technology to these countries.

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Prices of the reports, listed by order number, appear on page PL-1.

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CHEMISTRY

Beneficiation and Refining

IMPROVING NICKEL EXTRACTION FROM OXIDE ORES

Bureau of Mines, Salt Lake City Metallurgy Research Center. Parkman T. Brooks, and George M. Potter. September 1972. 7 pages.

PB–213 054

Recovering nickel from oxide minerals—garnierites, nickeliferous laterites, and laterites mixed with garnierite—is not always economically possible because much of the nickeliferous material is low grade and/or refractory to known extraction techniques. A simple and low-cost roasting modification for improving nickel extraction from relatively low-grade nickel- and cobalt-bearing weathered serpentine has now been demonstrated on a laboratory scale. The method is basically a reductive roast-ammonia leach process using a very small amount of sulfide mineral (*e.g.*, pyrite) mixed with the ore. Improved nickel extraction was achieved using Philippine and Caribbean ores.

----o----

OXIDATION OF PYRITES IN CHLORINATED SOLVENTS

Environmental Protection Agency, Office of Research and Monitoring; and NUS Corporation, Cyrus Wm. Rice Division. Joseph C. Troy, Joseph A. Boros, and Donald Brenneman.
November 1972. 54 pages.

PB–214 455

Whenever coal is removed from the earth, it is a necessary and common practice to separate unwanted materials from the coal. These materials—shale, clay, pyrite, soil, coal fines, etc.—are found in reject piles near coal mines, coal processing stations, and power plants. These piles often ignite spontaneously, seriously polluting the air with noxious fumes of sulfur dioxide. Also, the drainage from the piles can contaminate natural streams with iron sulfide and sulfuric acid. Processes are known for recovering coal fines from refuse piles, leaving a residue rich in pyrites. It has now been demonstrated that it is possible to extract valuable sulfur and iron compounds from this residue. The method, which is described in this report, essentially involves the chlorination of the pyrite in non-aqueous solvents. Recycling the chlorinated solvent through the pyrite significantly improved the rate of reaction.

----o----

PYROLYSIS-GAS CHROMATOGRAPHY–A METHOD FOR RAPID IDENTIFICATION OF POLYMERS

Air Force Materials Laboratory. Norbert Iglauer. December 1972. 108 pages.

AD–755–375

A pyrolysis gas chromatography method for the rapid identification of organic polymers is described. It has the advantage over previous similar methods that it can simultaneously identify both the small and large pyrolyzate components. The pyrograms obtained not only offer a "fingerprint" of the polymer, but also permit a detailed qualitative and quantitative analysis of the fragments of the pyrolyzate. The pyrograms of 68 elastomers, thermoplastics, and natural and synthetic fibers are provided for reference purposes.

----o----

A RAPID, SENSITIVE METHOD FOR THE DETERMINATION OF THE CHEMICAL OXYGEN DEMAND OF POLLUTED WATERS

Oak Ridge National Laboratory (AEC). W. Wilson Pitt, Jr., Sidney Katz, and Louis H. Thacker. August 1972. 20 pages.

CONF–720827–2

The chemical oxygen demand (COD) of waste waters and natural streams is one of the important parameters of the water. The standard method for determining COD, using dichromic acid, has the disadvantage of requiring significant manual attention and approximately 3 hours to complete. A new method for COD determination is described in this report which is based on the fluorescence analysis of perchloratoceric acid. The method requires only a few minutes for measuring the COD of waters at levels as low as 100 micrograms per liter. It is quite amenable to automation and can be used for continuous, remote stream analysis, as well as for the analysis of discrete samples.

----o----

HANDBOOK FOR ANALYTICAL QUALITY CONTROL IN WATER AND WASTEWATER LABORATORIES

National Environmental Research Center, Analytical Quality Control Laboratory. June, 1972. 106 pages.

PB–213 884

The role of the water and wastewater analytical laboratory is to provide qualitative and quantitative data to be used in decision making. To be valuable, the data must accurately describe the characteristics or the concentration of constituents in the sample submitted to the laboratory. In many cases, an approximate answer or incorrect result is worse than no answer at all, because it will lead to faulty interpretations. This handbook is addressed to laboratory directors, leaders of field investigations, and other per-

Chemical Analysis
(continued)

sonnel who bear responsibility for water and wastewater data. The subject matter is concerned primarily with quality control for chemical and physical test and measurements. Sufficient information is offered to allow the user to inaugurate, or to reinforce, a program of analytical quality control which will emphasize early recognition, prevention, and correction of factors leading to breakdowns in the validity of data. The specific areas covered include: Importance of quality control, laboratory services, instrumental quality control, glassware, reagents, solvents and gases, control of analytical performance, data handling and reporting, special requirements for trace organic analysis, and skills and training.

----o----

A THREE-MINUTE GAS CHROMATOGRAPHIC ANALYSIS OF THE MAIN CONSTITUENTS OF MINE ATMOSPHERES

Bureau of Mines, Pittsburgh Mining and Safety Research Center. Helen W. Lang, and Robert W. Freedman. 1972. 11 pages.

PB–213 968

A very rapid gas chromatographic method has been developed for routine determination of oxygen, nitrogen, methane, and carbon dioxide in mine atmospheres. The analysis is accomplished in three minutes, with the readout appearing on a single strip chart. The system can be adapted to other types of samples with minor modification. Construction and operating details are given in the document.

----o----

INSTRUMENTAL ANALYSIS OF CHEMICAL POLLUTANTS. TRAINING MANUAL

Environmental Protection Agency, Water Quality Office. April 1971. 298 pages.

PB–214 504

This manual is designed for analytical chemists and others having technical responsibility for the collection, identification, and measurement of organic and inorganic pollutants in the aquatic environment. It can serve both as a training manual and as a basic handbook on the subject. The first section deals with introductory concepts concerning water chemistry, the chemical nature of water pollutants, and instrumental chemical analysis. Subsequent sections give detailed coverage of chromatographic methodology, optical methods of analysis, and other operations and techniques involved n instrumental analysis.

----o----

Organic Chemicals

THE MECHANISMS OF PYROLYSIS, OXIDATION, AND BURNING OF ORGANIC MATERIALS

National Bureau of Standards, Institute for Materials Research. Leo A. Wall (Editor). June 1972. 199 pages.

COM–72–51084

Organic Chemicals
(continued)

This document is comprised of papers presented at a symposium, held in October 1970, which was organized for the purpose of intensively reviewing, examining, evaluating, and disseminating available data and knowledge on the complicated physical and chemical processes involved in the burning of organic materials. The subject matter covered includes: pyrolysis of hydrocarbons; pyrolysis of polymers; oxidation of polymers; oxidation of other organic compounds; and the burning of polymers and other organic compounds. The papers should be of interest to specialized investigators in the areas discussed, as well as to those concerned with such problems as flammable fabrics, fire safety, air pollution, waste disposal, recycling of organic materials, and the design of safe materials.

----o----

Process Engineering

PRODUCTION OF HCl AS A BYPRODUCT OF THE SOLVAY PROCESS

University of California (Berkely), Department of Chemical Engineering. Richard C. Forrester III, and Scott Lynn. 1972. 24 pages.

CONF–721106–1

Virtually all synthetic sodium carbonate (soda ash) is presently produced by the Solvay process, which requires NaCl, fuel, and limestone as raw materials. As one step in the process a concentrated brine is ammoniated, with the ammonia later being recovered in a process involving treatment with CaO. This recovery step yields $CaCl_2$ as a worthless byproduct. It has now been feasible to modify the ammonia recovery process to permit both NH_3 recovery and the product of HCl. This modification consists essentially of the substitution of reactive MgO for CaO, producing a concentrated $MgCl_2$ solution. Dehydration of the solution leads to the thermal decomposition of the $MgCl_2$, resulting in the regeneration of MgO and the production of HCl, which may be sold or converted to chlorine. Cost analysis of a 500-ton-per-day plant using the MgO modified Solvay process shows that it offers a significant economic advantage over the present (CaO) system.

----o----

SYNTHESIS OF SEPARATION SCHEMES

University of California, Department of Chemical Engineering and Lawrence Berkeley Laboratory.
Roger W. Thompson, and C. Judson King. July 1972. 179 pages.

LBL–614

The design of a chemical production process can roughly be divided into two steps—synthesis and analysis. Extensive attention has been given to analysis, but very little study has been devoted to the synthesis phase of process design, *i.e.*, the creation of the process scheme. A chemical production process generally consists of a reaction section followed by a section for chemical isolation (or separation). Often more than two products are to be produced in the separation section. The ability of a logical procedure, as programmed on a computer, to synthesize separation schemes has now been demonstrated. To accomplish this various heuristics of general applicability to synthesize separation trains have been created and evaluated. Also, a new general heuristic which should be of value to the design engineer, whether or not he is using the computer, is delineated and explored in some depth. A number of illustrative examples are given, and the necessary computer program listings are included.

----o----

CHEMICAL PROCESSING MANUAL

George C. Marshall Space Flight Center, Product Engineering and Process Technology Laboratory. F. G. Beyerle. November 1972. 918 pages.

N73–14117

This document provides a compilation of operational procedures for chemical processes applicable to a wide variety of metallic and non-metallic materials. The types of operations include solvent cleaning, emulsion cleaning, mechanical cleaning, acid cleaning, detergent cleaning, ultrasonic cleaning, anodic electrocleaning, cathodic cleaning, periodic reversal electrolytic cleaning, chemical milling, anodizing, testing of base metal, analysis of solutions, testing of coatings, plating, application of dry film lubricants, pickling, and polishing. The procedures were originally intended for use in the manufacture of spacecraft components and related equipment, but most of them should be useful in other applications.

----o----

WET SCRUBBER SYSTEM STUDY. VOLUME I. SCRUBBER HANDBOOK

A. P. T. Inc. Seymour Calvert, Jhuda Goldschmid, David Leith, nd Dilip Mehta. July 1972. 828 pages.

PB–213 016

Wet scrubbers are defined as devices which utilize a liquid in the eparation of particulate or gaseous contaminants (or components) rom a gas. They are used extensively for the control of air pollu-ion emissions and also in chemical process systems. This hand-ook represents an effort to present the base available engineering nformation on scrubbers. Both theory and empiricism are em-loyed where appropriate to the objective of providing the basis or the most effective use of scrubbers in air pollution control. mphasis is on providing a solid base of fundamental principles nd from that to build generally applicable design methods. The reas covered include: Scrubbers available (types available, com-ercially available scrubbers, scrubber patents; basic concepts concepts and unit mechanisms of mass transfer, concepts and unit echanisms of particle collection, gas-liquid contacting, effect of ressure and temperature on particle collection); design methods; uxiliaries (gas moving, liquid moving, entrainment separation,

Process Engineering (continued)

solvent recycle, sampling and analysis, controls, health and safety); scrubber performance on industrial emissions; system analysis, costs, and optimization; design examples; physical and chemical data; materials data; liquid and solid waste disposal (industry neutralization and chemical precipitation, ion exchange, desalting, disposal of liquid, disposal of solids, economics).

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WET SCRUBBER STUDY. VOLUME II: FINAL REPORT AND BIBLIOGRAPHY

A. P. T. Inc. Seymore Calvert, Jhuda Goldschmid, David Leith, and Dilip Mehta. July 1972. 181 pages.

PB–213 017

This document concerns a study of wet scrubber technology which had the following objectives: Evaluation of current engineering technology; evaluation of existing scrubber systems; investigation of present usage problems; determination of potential new applications; and development of specific research recommendations. The results of each of these objectives are discussed in detail. In addition, a bibliography on wet scrubbers containing about 1,700 entries is provided. The topics covered include: Basic principles; gas liquid contacting; unit mechanisms; effects of temperature and pressure; mass transfer; particle collection; auxiliaries; industrial processes utilizing scrubbers; systems analysis; design examples; physical and chemical data; materials data; liquid and solid waste disposal.

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Waste Processing and Materials Recovery

WASTEWATER MANAGEMENT BY DISPOSAL ON THE LAND

Army Corps of Engineers. S. Reed, M. Bilello, S. Buda, et al. May 1972. 190 pages.

AD–752 132

One possible final step in most wastewater treatment schemes is the disposal of partially treated effluent on the land. This report presents a comprehensive technical assessment of the effects and effectiveness of three methods for land disposal of secondary treated wastewater. The three application techniques considered are spray irrigation, overland runoff, and rapid infiltration. Nine essentially independent chapters cover the following topics: Review of secondary treatment processes; role of soil chemical processes in reclamation of wastewater applied to land; microbial responses to land disposal; botanical components involved in land disposal; hydrologic aspects; health and hygiene aspects of spray irrigation; response of receiving waters to land disposal effluents; alternative processes and combinations; impact of climatology and meteorology on land disposal.

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AUTOMATION OF WASTEWATER TREATMENT SYSTEMS

Environmental Consultants, Inc. Joseph L. Pavoni, and Peter R. Spinney. December 1972. 255 pages.

AD–753 926

The past three decades have witnessed unparalleled advances in instrumentation applications in most areas of science and industry. Despite practical applications of these technological improvements by many unrelated fields of endeavor, the wastewater treatment profession has lagged considerably behind others in instrumentation applications to its various unit processes. This report reviews and evaluates the present state of the art technology for automating new or expanded wastewater treatment facilities, and for upgrading the performance of existing treatment plants. The first portion reviews the fundamental concepts of automatic control. The following sections discuss the possibilities of applying automatic control to preliminary sewage treatment (flow measurement, harmful solids reduction, and odor control); biological wastewater treatment systems; sludge handling and disposal; and post chlorination. Consideration is also given to instrumentation of anaerobic digesters; automatic sample collection; and the automation and control of typical wastewater treatment plants. A list of equipment manufacturers is included.

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HYPERFILTRATION AND CROSS-FLOW FILTRATION OF KRAFT PULP MILL AND BLEACH PLANT WASTES

Oak Ridge National Laboratory; and Massachusetts Institute of Technology, School of Chemical Engineering Practice. J. Acosta, J. Csurny, J. T. Day, *et al.* May 1972. 91 pages.

ORNL–NSF–EP–14

The pulping of wood and the papermaking process require enormous quantities of water. Water is used to carry cellulose fibers through the bleaching, refining, and paper-forming phases of manufacture, and, as the solvent for various chemicals, separates the unwanted waste products in solution or suspension. Waste products thus occur in the water in highly dilute form and are characterized chiefly by suspended solids and soluble organics (many intensely colored), both of which are objectional for biological and aesthetic reasons when discharged to open waterways. Hyperfiltration (reverse osmosis) with dynamic membranes and low-pressure pressure filtration have been tested for the treatment of these waste effluents. Emphasis was placed on the effluent from the caustic extraction stage in the bleaching process, but some experiments were also carried out with clarifier influent and simulated pulp-washer effluent (diluted black liquor). The results suggest many possible procedures and combinations that may be applicable at specific points in the kraft process both for the purification of effluent and the recovery of process chemicals.

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STATE OF THE ART OF TEXTILE WASTE TREATMENT

Clemson University, Department of Textiles. John J. Porter. February 1971. 356 pages.

PB–212 359

This report provides a review of current waste treatment methods and practices used in the textile industry. The scope of subject coverage includes the following: Characteristics of textile waste; waste treatment techniques; treatment methods in use; effects of textile wastes on receiving waters; the cost of waste treatment operations; and areas of needed research. An annotated bibliography is included, which contains abstracts of selected publications concerning synthetic fiber manufacturing wastes, detergent waste treatment, instrumentation, plant design, water treatment for plant use, as well as articles pertaining specifically to textile waste treatmen.

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PRELIMINARY INVESTIGATIONAL REQUIREMENTS–PETROCHEMICAL AND REFINERY WASTE TREATMENT FACILITIES

Engineering-Science, Inc./Texas. William Jewell, and Davis L. Ford. March 1971. 203 pages.

PB–212 369

The preliminary investigation undertaken at a refinery or other petrochemical complex relative to the successful treatment of wastewaters should include those factors essential in the proper development of design criteria for pollution abatement and control facilities. This report compiles and organizes the many components which constitute such a preliminary wastewater treatment survey. Factors essential for the development of design criteria for pollution abatement and control facilities are included.

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A STUDY TO IDENTIFY OPPORTUNITIES FOR INCREASED SOLID WASTE UTILIZATION. VOLUME I.

Battelle Memorial Institute, Columbus Laboratories. 1972. 178 pages.

PB–212 729

A STUDY TO IDENTIFY OPPORTUNITIES FOR INCREASED SOLID WASTE UTILIZATION. VOLUMES II TO VII.

Battelle Memorial Institute, Columbus Laboratories. 1972. 608 pages.

PB–212 730

A STUDY TO IDENTIFY OPPORTUNITIES FOR INCREASED SOLID WASTE UTILIZATION. VOLUMES VIII TO IX.

Battelle Memorial Institute, Columbus Laboratories, 1972. 342 pages.

PB–212 731

There are several basic underlying motivations for the encouragement of the recovery and utilization of solid waste materials. These include the conservation of natural resources, pollution control, and the fact that recovered, or secondary, materials may be less costly than virgin materials. This series of documents is concerned with greater solid waste utilization; it provides the results of a thorough analysis of the secondary materials industry, its sources of supply, its consuming markets, and its economic and technological problems. Volume I provides a summary of the other 8 volumes, plus an analysis of activities and recycling problems common to all commodities. Areas of commonality include such matters as legislation and its effect on recycling, and a description of the equipment used in processing secondary materials. The remaining volumes deal with specific commodities (Vol's. II through VII cover aluminum, copper, lead, zinc, nickel, stainless steel, and precious metals; Vol's. VIII and IX cover paper and textiles). Problems inhibiting increased recycling of these materials are identified, and recommended actions are proposed.

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RECOVERY OF PRECIOUS METALS FROM ELECTRONIC SCRAP

Bureau of Mines, Salt Lake City Metallurgy Research Center. R. O. Dannenberg, J. M. Maurice, and G. M. Potter. 1972. 22 pages.

PB–213 065

The electronics industry requires enormous quantities of precious metals yearly. Ultimately most of the equipment into which these metals go is scrapped for various reasons, making the scrap an important potential source of secondary metal. At present a low precious metal content or a material complexity renders recovery unfeasible, so that investigations are under way to devise processes which can economically recover these metals from the scrap. A methodology is reported comprising incineration, caustic leaching to remove aluminum, smelting with a siliceous slag and electrolysis to recover copper, and anode slime collection to recover over 93 percent of silver and gold. Evaluation of process costs is made and recommendations are given for the most economic approach.

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IDENTIFICATION OF OPPORTUNITIES FOR INCREASED RECYCLNG OF FERROUS SOLID WASTES

Institute of Scrap Iron and Steel, Inc. W. J. Regan, R. W. James, and T. J. McLeer. 1972. 408 pages.

PB–213 577

The reclamation of waste materials for reuse—the recycling concept—has both economic advantages and social ones. Among the latter are the conservation of resources and the reduction of solid waste pollution. The recycling of iron and steel wastes is a long-established industry. This document presents the results of a study which was undertaken to identify opportunities for increased recovery and reuse of ferrous scrap—particularly in the light of the above newly-prominent social concerns. It examines the sources, types, and quantities of iron and steel scrap; the markets for iron and steel scrap; the functions of the ferrous scrap processing industry; and the technology of iron and steel scrap utilization. Problems inhibiting greater use of iron and steel scrap are identified and discussed, and recommendations are made for solutions to these problems.

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PILOT SCALE UP OF PROCESSES TO DEMONSTRATE UTILIZATION OF PULVERIZED COAL FLYASH MODIFIED BY THE ADDITION OF LIMESTONE–DOLOMITE SULFUR DIOXIDE REMOVAL ADDITIVES

West Virginia University, Coal Research Bureau. William Lawrence, Richard Muter, Ronald Anderson, and Linda Condry. October 1971. 109 pages.

PB–213 639

The increasing waste disposal problem associated with coal combustion may be compounded several fold by the greater amount of waste generated if potential alkaline earth sulfur dioxide abatement systems are implemented. Although utilization schemes for normal flyash are available, the modified flyash resulting from limestone/dolomite sulfur sorption programs represents a new type of solid waste material having different chemical and physical properties from regular flyash. Several promising utilization schemes for this material have now been developed. These include:

Production of autoclaved structural material such as calcium-silicate, brick, concrete, and aerated concrete; production of high temperature materials such as mineral wool; and use of modified ash as an agricultural soil amendment. The results of bench-scale studies of these processes are described in this document.

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STATUS OF ADVANCED WASTE TREATMENT

National Environmental Research Center, Advanced Waste Treatment Research Laboratory. I. J. Kugelman. May 1972. 80 pages.

PB–213 819

A program which seeks to upgrade the state of the art of wastewater treatment technology has been in progress for over a decade at the National Environmental Research Center. As a result of the research activities fostered by this program, new treatment techniques have been developed and the performance of existing processes improved. In this document, a general review of the advanced waste treatment program is given with emphasis on those developments which are ready for full scale engineering application. The topics covered include: Wastewater characteristics; conventional treatment technology; biological-physical treatment; phosphorus removal; breakpoint chlorination; ammonia removal by air stripping; organic carbon removal; dissolved inorganics removal; tertiary treatment.

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NEW CHEMICAL CONCEPTS FOR UTILIZATION OF WASTE PLASTICS

TRW Systems Group. M. E. Banks, W. D. Lusk, and R. S. Ottinger. 1971. 136 pages.

PB–214 031

An analytical investigation has been undertaken of the use of waste plastics for the production of high-volume process chemicals. The investigation involved: The identification of plastic/coreactant reaction products with potential commercial value; identification of plastic/air reaction products that are potential air pollutants; development of technical and economic evaluations for chemical processes utilizing waste plastics as raw materials; and identification of potential research and development programs leading to the development of commercially viable chemical processes. Of the various processes considered, the following were demonstrated to be technically and economically feasible: polystyrene-thermal decomposition, polyvinyl chloride-thermal decomposition, mixed plastics-thermal decomposition, and mixed plastics-combustion with air.

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INCENTIVES FOR RECYCLING AND REUSE OF PLASTICS

Arthur D. Little, Inc. Jack Milgrom. 1972. 316 pages.

PB–214 045

Plastics contribute special difficulties in solid waste management, since their disposal characteristics are not yet fully known. Because they are derived from limited petroleum resources and at the same time are increasing rapidly in use, management of their wastes requires intensified research. The reported study had two aims: to develop a model of the plastics cycle, and to develop strategies for recycling and reuse. The discussion begins with plastics technology; continues with the economics of development, recycling considerations, and markets for both virgin and secondary materials; and describes the cycle from petrochemicals to finished products for the consumer. An analysis is made of present methodology for isolating plastics from other solid waste and applications for the scrap material. Finally the promotion of recycling and reuse is studied.

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PHYSICAL-CHEMICAL PROCESSES

Environmental Protection Agency, Advanced Waste Treatment Research Laboratory. I. J. Kugelman, and J. M. Cohen. March 1972. 54 pages.

PB–214 111

The most recent advance in the art of sewage treatment is the application of physical-chemical technology to raw sewage treatment. Physical-chemical treatment can now be considered an acceptable alternative to conventional treatment, especially for situations where sufficient phosphorous removal is required. This document provides a basic review of the state of the art of physical-chemical treatment technology. Consideration is given to the clarification-adsorption process: chemical clarification; carbon adsorption; description and performance of some existing physical-chemical pilot plants; advantages of physical-chemical treatment vs. conventional treatment; and cost estimates.

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AIR CLASSIFICATION OF SOLID WASTES

Stanford Research Institute. R. A. Boettcher. 1972. 75 pages.

PB–214 133

Results are given of studies undertaken to determine the technical feasibility of using air classification to process selected types of nonhomogenous dry solid wastes for the purpose of reclaiming a portion of the waste for reuse. The results obtained with laboratory and pilot-scale zigzag air classification units indicate that the method is indeed feasible. Design requirements for processing solid wastes with a full-scale commercial unit are estimated and the required supplemental equipment (shredders, screens, dryers) are identified. Limitations and advantages of the method are listed. The report is intended primarily to acquaint interested engineers with characteristics of the air classification device and to suggest potential applications for separating solid wastes. It also contains speculations on the role that this equipment might have in the management of solid waste.

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SALVAGE MARKETS FOR MATERIALS IN SOLID WASTES

Midwest Research Institute. Arsen Darnay, and William E. Franklin. 1972. 331 pages.

PB–214 152

This document is concerned with the economics of salvage. Its underlying purpose is to elucidate the value relations between virgin materials and secondary materials so that intelligent planning and action can take place to salvage recoverable materials. The first section reviews the current state of the salvage industry, the sanitation establishment which supplies secondary materials at times, and industrial buyers and sellers of secondary commodities. Various facts and trends that are general to salvage activity as a whole are presented. Salvage operations and operating costs, including emerging patterns in salvage, are then discussed. The objective is to present cost data in one place and to identify the emergence of new technology and new socioeconomic developments which together promise to introduce changes into salvage. This is followed by a series of detailed discussions of commodity classes: paper, ferrous metals, nonferrous metals, glass, textiles, rubber, plastics, and other materials. Finally, a number of actual salvage operations are described. A fairly extensive bibliography is included.

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OPTIMIZING DECOMPOSITION OF CARBONYL SULFIDE IN AN ELECTRICAL DISCHARGE

Bureau of Mines, Twin Cities Metallurgy Research Center. Larry A. Haas, Carl F. Anderson, and Sanaa E. Khalafalla. 1972. 22 pages.

PB–214 210

The toxic gas carbonyl sulfide, COS, is generated in petroleum refineries and in processes involving reactions between sulfurous and carbonaceous materials. It has been found that elemental sulfur can be recovered from this gas by dissociation in an electrical discharge. This report provides the results of an effort to optimize the various variables in the process. These include COS, gas flow rate, electrode gap, reactor volume, temperature, applied voltage, dilutent gases, and gas additives.

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RECOVERING PLASTICS FROM URBAN REFUSE BY ELECTRODYNAMIC TECHNIQUES

Bureau of Mines, College Park Metallurgy Research Center. Michael Grubbs and Kenneth H. Ivey. December 1972. 9 pages.

PB–214 267

Considerable work is being undertaken by a number of organizations to develop economically acceptable means for recovering various recyclable materials from unburned urban wastes. A method has now been developed, and described in this report, which is capable of recovering a mixed plastic concentrate from the light material fraction of shredded refuse. The method involves feeding mixed refuse on to a metal drum which turns through an electrical corona formed between the grounded drum and a wire electrode. The plastics adhere to the drum, and the paper fraction is attracted to the electrode. Recoveries of 99.4% of the plastic and 100% of the paper are attainable. It has also been demonstrated that a substantial quantity of polyvinyl chloride can be separated from the mixed plastic concentrate using the same technique with a larger diameter electrode.

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WASTE GLASS AS A FLUX FOR BRICK CLAYS

U.S. Bureau of Mines, Tuscaloosa Metallurgy Research Laboratory. M. E. Tyrrell and Alan H. Goode. 1972. 13 pages.

PB–214 271

From the millions of tons of glass discarded annually in municipal wastes, increasing amounts are being recycled from the output of waste recovery incinerators. Now a use has been suggested for the residue glass of these incinerators, so contaminated as to be useless for recycling; a flux for brickmaking. Experiments have shown that substitution of the crushed glass residue for a substantial part of the clay material for bricks reduces the firing temperature 400 to 500° F and makes possible a 23 to 30 percent increase in brick production. The report discusses the formation and firing of waste glass and common clay mixtures. It describes chemical components in the glass, firing characteristics of several mixtures tested, the glass-clay ratios used, heat requirements, and firing times. Some indications are made for the future of this technology.

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BIBLIOGRAPHY OF LIVESTOCK WASTE MANAGEMENT

Iowa State University, Agricultural Engineering Department. J. Ronald Miner, Dwaine Bundy, and Gerald Christenbury. December 1972. 148 pages.

PB–214 410

A bibliography is provided of the literature on the disposal of animal wastes not associated with industrial plants. Specific sources of concern are those from beef cattle, swine, poultry, dairy cattle, sheep, and other animals of economic importance, whether in roofed or unroofed systems. Areas of interest are water pollution, odors, waste characteristics, storage, transport, treatment, utilization, and disposal. Not included are articles dealing with wastes from animal processing after slaughter or animal products from packing houses, dairies, rendering plants, or cheese plants. Prime considerations in the bibliography are pollution and disposal. The bibliography contains a total of 945 entries; subject and author indexes are included.

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PROCEEDINGS THIRD NATIONAL SYMPOSIUM ON FOOD PROCESSING WASTES

Environmental Protection Agency, Pacific Northwest Water Laboratory. November 1972. 495 pages.

PB–214 418

This document is comprised of 20 papers which were presented at a conference on the treatment and control of waste materials in the food processing industry, which was held in March 1972. The papers cover a wide range of research and demonstration projects on new methods of waste treatment, with emphasis on in-plant process changes to reduce or eliminate liquid waste flows. Some of the specific topics are: Reduced waste generation by alternate vegetable blanching systems; field study on the application of individual quick blanching; waste control in the processing of sweet potatoes; treatment of soy whey by membrane processes; full-scale anaerobic trickling filter evaluation; ice cream wastewater characterization and treatability; use of chemical treatment and air flotation for the clarification of fish processing plant waste water; tertiary treatment of combined domestic and industrial wastes; ocean assimilation of food residuals; process design for treatment of maize wet milling wastes; winery wastewater treatment; characterization and treatment of brewery wastes; cattle paunch contents as fish feed supplement; characterization of fruit and vegetable processing wastewaters; seafoods processing wastewater characterization.

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PROCESS DESIGN MANUAL FOR UPGRADING EXISTING WASTEWATER TREATMENT PLANTS

Roy F. Weston, Inc. P. Krishnan, and C. M. Mangan. October 1971. 275 pages.

PB–214 550

Upgrading of wastewater treatment plants may be required to handle higher hydraulic and organic loadings. Such situations require the optimization of existing facilities before consideration of additional treatment facilities. This manual presents necessary information for considering various courses of action with regard to an impending or existing plant overload situation, or with regard to increasing the efficiency to meet stricter water quality standards. It is aimed at establishing a framework of possible alternative methods of upgrading treatment plants having capacities up to 5 mgd. Particular upgrading procedures are stressed as interim methods which may be implemented with a minimum amount of effort and capital expenditure prior to a more elaborate upgrading or even a major plant expansion.

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PROCESS DESIGN MANUAL FOR SUSPENDED SOLIDS REMOVAL

Burns and Roe, Inc. October 1971. 149 pages.

PB–214 551

This manual is intended to provide the engineering community and related industry with a source of information on suspended solids removal during the wastewater treatment process. The aspects considered include: Population and design period forecasting; flow equalization; coagulation of wastewater; chemicals and feeding; chemical processes; gravity systems; physical straining processes; deep bed filtration; operation and maintenance; cost estimates; and plan and specification review. The information and data provided are presented in such a manner that they can be readily incorporated into practice.

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PROCESS DESIGN MANUAL FOR CARBON ABSORPTION

Swindell-Dressler Company. October 1971. 95 pages.

PB–214 552

Activated carbon can be used to reduce the pollution load of many kinds of waste and raw waters. It is particularly well suited for removal of various types of dissolved organic materials. This manual examines major design parameters and unit operations which are important in carbon adsorption systems. Existing carbon plant designs are evaluated, and various plant configurations are discussed. Costs are evaluated for the various unit operations. Carbon regeneration, a prerequisite for economic feasibility, is discussed and the necessary equipment is described. Other aspects considered include: Air pollution control devices for the regeneration furnace; personnel requirements; isotherm and pilot testing; carbon dewatering; and biodegradation of organics in carbon columns.

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PROCESS DESIGN MANUAL FOR PHOSPHORUS REMOVAL

Black and Veatch, Consulting Engineers. October 1971. 195 pages.

PB–214 553

The technology for removal of phosphorus from wastewater has developed rapidly in the last few years. This development has resulted from the realization of the extent of the over-fertilization and eutrophication of natural waters caused by phosphorus in discharges. This manual discussed a number of phosphorus removal methods that involve chemical precipitation. Included in the discussion of each treatment method is a description of the method, pilot or full scale performance data, equipment requirements, design parameters, and costs. This information should be of use to designers, government officials and agencies, city planners, and treatment plant operators.

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ASPHALT PAVING MIXTURES PRODUCED BY THE DRYER-DRUM PROCESS

Bituminous Materials

University of Washington; and Federal Highway Administration. Ronald L. Terrel, and Emory S. Richardson. August 1972. 136 pages.

PB–212 854

The manufacturing and placing of hot asphalt paving mixtures has become a routine and standardized procedure for most producers throughout the world. However, only minor efforts have been made to modernize the technology of asphalt paving at a rate consistent with other contempory industry. The dryer-drum process for producing asphalt paving mixtures now appears to have the potential for advancing the state-of-the-art. In this process, the conventional hot bins, hot bin screens, and pugmill are replaced by cold feed controls. There are considerable economic benefits associated with the use of this process, and fewer stack dust emissions are produced. Field observations and laboratory investigations, described in this report, have demonstrated that the process produces a satisfactory product.

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USE OF HYDRATED LIME IN BITUMINOUS MIXTURES TO DECREASE HARDENING OF THE ASPHALT CEMENT

Utah State Highway Department, Materials and Tests Division. Catherine V. Chachas. December 1971. 81 pages.

PB–213 170

It is well known that asphalt hardens with age. When this occurs in asphaltic pavements, cracking and raveling occur which cause deterioration of the pavement. Field and laboratory investigations have now demonstrated that the use of one percent hydrated lime in bituminous mixtures is beneficial in decreasing the hardening tendencies of asphalt by reducing its viscosity. The beneficial effect is more pronounced in bituminous mixtures made with siliceous aggregates than those made with calcareous aggregates. Thus siliceous aggregates, which are regarded as being of inferior quality, may now be used without sacrificing pavement performance. Other improvements observed in bituminous mixtures by the addition of hydrated lime include increased resistance to moisture, stability improvement, increase in flexibility of structures fabricated from the mixtures and reduction in the oxidation rate of the asphalt.

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FUNDAMENTAL RESEARCH ON MACHINING OF BRITTLE MATERIALS

Honeywell Inc., Corporate Research Center. December 1972. 25 pages.

AD-753 027

Ceramic materials are finding application where ther unique physical properties are specifically exploited in components and devices. Many of these applications demand great precision and high performance, which in turn means that fully dense ceramics must be machined to microinch tolerances with no loss in physical properties. Ceramic machining of precision parts involves many successive steps from the rough hogging operation, to semi-finish grinding, to final grinding, polishing, and lapping. This report summarizes the results of research conducted over a four year period on the nature of surface damage introduced into various types of ceramic materials by ceramic machining operations and the forces and mechanisms involved. Consideration is given to the nature of the machined single crystal and polycrystal surface; measurement of the grinding forces and grinding energy involved in machining single crystals and polycrystals; effects of machining on the physical properties of ceramics; and effects of environment in ceramic machining.

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CERAMIC MATERIALS

Defense Documentation Center. February 1973. 360 pages.

AD–755 650

This bibliography is comprised of abstracts of reports resulting from U.S. Government research on ceramic materials. General materials include the processing and manufacture of ceramic materials, ceramic coatings, physical properties, high temperature applications, and use in electronic devices. Some of the topics included are hardening, dielectrics, crystal and microstructure, powders, heat treatment, particles, surface properties, aging, oxides, metal compounds, whiskers and fibers, lasers, refractories, creep, degasification, sintering, mechanical models, grinding, heat transfer, carbides, spraying, vapor deposition, capacitors, electron tubes, high voltage, reliability, ferroelectric materials' holography, crack propagation, spinels, doping, stress characteristics, corrosion, and allied topics. Indexes are included.

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MOLDING OF ORIENTED SHORT FIBER COMPOSITES. I. ULTIMATE TENSILE PROPERTIES

Monsanto Research Corporation. Lloyd A. Goettler. December 1972. 71 pages.

AD–754 763

Injection and transfer molding afford an economical means to fabricate, on a large volume basis, composite materials having short fiber reinforcements. This report describes the dependence of the structural parameters of such composites on the material and processing variables and how they, in turn, influence the tensile strength and elongation properties. The ultimate, rather than the elastic, properties are treated because they are more sensitive to the structural variables. The structural parameters considered are fiber length, fiber concentration, void content, dispersion of fibers, fiber orientation, and wetting.

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FIBER REINFORCED CERAMICS: A REVIEW AND ASSESSMENT OF THEIR POTENTIAL

Air Force Materials Laboratory, Metals and Ceramics Division. J. J. Krochmal. October 1967. 85 pages.

AD–824 938

The area of fiber reinforced ceramics is one that has been regarded as a potential panacea for many of the problems that arise when attempts are made to employ brittle ceramic materials as components where loads are induced by mechanical or thermal means. This report reviews research that has been conducted in this area and assesses those opportunities that might exist whereby future gains may be realized. The first section provides a review of previous work in this area. This is followed by an examination of all combinations of a number of filamentary materials (W, Mo, Ta, B, C, SiC, B_4C, and Al_2O_3) with the following technologically interesting matrix materials: ZrB_2, HfB_2, SiC, ZrC, HfC, TaC, WC, Al_2O_3, BeO, MgO, ThO_2, ZrO_2, $MgAl_2O_4$, $MoSi_2$, and WSi_2. Finally, a discussion is provided of various behavioral and materials-oriented considerations in selecting fiber-matrix combinations.

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RADIATION CROSSLINKING OF POLYMERS WITH SEGREGATED METALLIC PARTICLES

Drexel University, Department of Metallurgical Engineering. D. T. Turner, A. Malliaris, and R. P. Kusy. January 1973. 84 pages.

COO–3035–1

One way of imparting thermal or electrical conducting properties to polymeric materials is to include a metallic compounding ingredient. The usual disadvantage is that such materials are costly because of the high volume fraction of metal required. However, a previous report (NYO-4110; see AMTID, Oct. 1972, page 20) described how this volume fraction could be greatly reduced by a

Composite Materials
(continued)

simple molding procedure and by radiation-induced crosslinking of the polymer. The method still had several deficiencies involving the limited number of suitable polymers and the high gamma-radiation doses required. This document describes work which was done to overcome these deficiencies. The various sections describe: The preparation of an electrically conducting composite of a polyurethane containing nickel particles; the use of the polyfunctional monomer allyl methacrylate to increase radiation-induced crosslinking in these composites; the remarkable corrosion resistant compacts prepared using nickel with either polyethylene or polytetrafluoroethylene; and the influence of gamma-rays on the transition temperatures of polytetrafluoroethylene.

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EVALUATION OF REINFORCED PLASTIC MORTAR PIPE–A GOVERNMENT-INDUSTRY COOPERATIVE STUDY

Bureau of Reclamation, Engineering and Research Center. Carl E. Selander, Michael E. Hickey, Fred E. Causey, and Amster K. Howard. August 1972. 72 pages.

PB–213 675

Pipe for water conveyance is of major importance in distribution and delivery systems for irrigation, municipal supply and industrial use. Much research goes into the production of pipe having improved safety characteristics, reduced water loss from seepage and evaporation, good water-quality properties, and maintainability. An investigation is reported of a reinforced plastic mortar pipe, composed of polyester resin, silica sand, and glass filament reinforcing. The several components are described, fabrication methods are outlined, performance over time is discussed, and the results of a test program are given, with some conclusions. Advantages of this pipe include good resistance to corrosion and chemical attack, no inherent cracking, and a weight light enough to greatly facilitate handling and installation operations.

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Concrete
(Nonbituminous)

CONCRETE-POLYMER COMPOSITE MATERIALS DEVELOPMENT

Brookhaven National Laboratory, Department of Applied Science. Meyer Steinberg. February 1972. 18 pages.

BNL–16609

A concrete-polymer composite materials program is underway which is directed at developing both improved and new concrete materials by combining the ancient technology of hydraulic cement concrete formation with the more modern technology of polymer chemistry. A wide range of concrete-polymer materials is being investigated. This report reviews the formulation and properties of these materials and discusses some possible applications.

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PERLITE-POLYMER CONCRETE

Brookhaven National Laboratory, Department of Applied Science. L. E. Kukacka. May 1972. 25 pages.

BNL–16931

Techniques have been developed for preparing lightweight insulating-type polymer-impregnated concrete composites with uniform polymer distributions and with hard, continuous polymer coatings. These composites, which have high strength and durability were produced by impregnating pearlite concrete with methyl methacrylate or polyester-styrene. Structural properties equivalent to or greater than high quality normal weight concretes were attained. The weight of the composite material is about ½ that of normal concrete. Prototype sections of a lamp post and a pipe were made, and the fabrication of larger sections is judged to be technically feasible. In general, it appears that a high quality lightweight pearlite-polymer concrete material can be produced which will find uses as a structural material.

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CONCRETE - POLYMER MATERIALS FOR HIGHWAY APPLICATIONS. PROGRESS REPORT NO. 2

Brookhaven National Laboratory, Department of Applied Science. L. E. Kukacka, P. Colombo, A. J. Romano, *et al.* April 1972. 172 pages.

BNL–50348

A research program is being undertaken to determine the properties of concrete-polymer materials and to find and develop highway applications. This report gives the results obtained so far in this program. In general it appears that great improvements in the structural and durability properties of highway-quality concrete can be obtained by monomer impregnation and *in situ* polymerization by either radiation or thermal-catalytic means. Design studies for precast bridge decks indicate that lightweight durable decks can be made. Techniques for producing high-strength and durable polymer impregnated concrete from lightweight insulating-type concretes were developed, and the successful fabrication of prototype roadway lampposts and pipes from this material indicates that it is suitable for structural applications. The feasibility of repairing deteriorated bridge decks by partial impregnation and *in situ* polymerization was demonstrated in field experiments.

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TIME-DEPENDENT BEHAVIOR OF NONCOMPOSTE PRESTRESSED CONCRETE STRUCTURES UNDER FIELD AND LABORATORY CONDITIONS

University of Illinois. V. Mossiossian, and W. L. Gamble. May 1972. 538 pages.

PB–212 619

The dimensional instability of plain, reinforced and prestressed concrete members is the result of creep and shrinkage in concrete. These deformations do not influence the strength of plain and reinforced concrete appreciably. However, the advent of prestressed concrete, and bridges and multistory structures over larger spans, has enhanced the importance of long time deformations of such structures due to serviceability requirements, and has required a clear understanding of mechanisms involved in creep and shrinkage and the principal parameters controlling them. It is the intent of this document to provide a fundamental understanding of the effects of creep, shrinkage, and material properties on the time-dependent behavior of noncomposite and composite prestressed structures under sustained loads and subjected to fluctuating temperature and humidity conditions in the field, and under laboratory storage conditions; and to present a method of analysis suitable for predicting the time-dependent deformations of such structures. It is based on both analytical and experimental studies, which are described in detail. Practical recommendations are made for taking into account the effects of creep and shrinkage in the design of prestressed beams and composite prestressed structures.

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IMPREGNATION OF CONCRETE PIPE

Southwest Research Institute. Allen C. Ludwig, and John M. Dale. June 1971. 78 pages.

PB–213 442

Concrete is a low cost, high strength material that is resistant to water damage at normal temperatures. Because of this, concrete is used extensively in water and sewer systems. Under certain circumstances, however, concrete pipe is subject to corrosive attack. This report gives the results of an investigation of a large number of materials as potential impregnants for concrete sewer pipe to impart corrosion resistance, reduce permeability, and improve strength. It was found that impregnation with relatively low cost resins such as asphalt, coal tars, linseed oil, sulfur, and urea-formaldehyde rendered concrete pipe 10 to 30 times more resistant to corrosion than untreated pipe. Six other materials (vinyl-vinylidene chloride, vinyl acetate-acrylic, nitrile rubber latex, nitrile-phenolic rubber, an emulsified reclaimed rubber, and a rubber base adhesive), although failing to impregnate the concrete, formed surface coatings having exceptional resistance to corrosion. Techniques of applying the materials are described, and the economics of their use are discussed.

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METHODS OF CONTROLLING GROUT FOR PRESTRESSED, POST-TENSIONED STRUCTURES

State of California, Division of Highways, Materials and Research Department. R. E. Weaver, J. L. McCormick, R. L. Watkins, and R. J. Freeman. November 1971. 30 pages.

PB–213 568

The corrosion of high-strength, prestressing steels in concrete became of serious concern with the increased use of prestressed concrete coupled with the fact that the grouting of ducts is not trouble-free. If the ducts are not completely filled with grout, then some degree of corrosion of the streel can be anticipated. An ideal cement grout for this purpose would have low viscosity during the pumping operation, have no shrinkage or volume reduction due to settlement or hardening, be slightly expansive in nature during the plastic stage, and have reasonable strength after curing. This document gives the results of an effort to find the necessary steps with regard to mixing techniques that will produce grout having these ideal qualities. It was determined that, within limits, the greater the effective mixing energy, the better the physical properties of the grout. Also, it was found that viscosity is the most practical indicator of overall grout quality.

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DETERMINATION OF THE CEMENT CONTENT OF HARDENED CONCRETE BY SELECTIVE SOLUTION

Virginia Highway Research Council. Gerardo G. Clemena. October 1972. 28 pages.

PB–213 855

Because cement content influences many of the important properties of concrete and because it is often the basis for contractural obligations, it is important to have available some simple method for the determination of the cement content of concrete that is reasonably accurate and applicable in field testing. A method involving selective solution by methanolic maleic acid has been found to provide a relatively simple and inexpensive means to this end. It is accurate to ±1 percentage point cement at 95% confidence level. Cement type, curing time, and water-cement ratio have no effect on the results, although aggregate type did have some effect.

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TIME-DEPENDENT BEHAVIOR OF CONCRETE UNDER SUSTAINED LOAD AND CYCLIC TEMPERATURE

University of California, Structural Engineering Laboratory. Hani M. Fahmi, Milos Polivka, and Boris Bresler. April 1972. 152 pages.

PB–214 140

Concrete (Nonbituminous)
(continued)

Creep deformation has long been known to occur in concrete structures. When concrete is subjected to changes in temperature and humidity, a large increase in creep may be observed. Consequently a real understanding is being sought of the mechanisms of creep and shrinkage, particularly as related to the internal microstructure of the cement paste. The report is concerned with the behavior of concrete over time under sustained loading at various or cyclic temperatures. Tests are discussed using micro-concrete hollow cylindrical specimens of a particular size at two different relative humidities, under sustained compressive or torsional loading, with unloaded control specimens given the same environmental conditions for comparisons. Behavior at 100% relative humidity was of especial interest. Axial deformations were measured with dial and strain gages, angular deformations in torsion with dial gages. A mathematical expression was developed in terms of material characteristics for predicting the type of creep. A mathematical model also was developed for constant and variable temperatures. The theoretical data were compared with experimental creep data, and found to agree.

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Corrosion

EVALUATION OF CORROSION INHIBITING PIGMENTS FOR ALUMINUM

Naval Air Development Center. William C. Marshall. August 1972. 12 pages.

AD–749 705

Various inhibitors were screened to determine their effectiveness for the protection of aluminum alloys from corrosion. It was found that the use of inhibitors having some solubility of hexavalent chromium in salt solution, as evidenced by the characteristic ion color, resulted in very little weight loss in aluminum test specimens, and very little visible corrosion. Conversely, materials which are insoluble in salt solution permitted high weight losses and severe visual corrosion. Inhibitive pigments which may be satisfactory for steel did not necessarily exhibit good performance when used on aluminum. Zinc and strontium chromates, which combine low cost with adequately controlled solubility, seem to be the corrosion inhibiting pigments of choice for application to aluminum alloys.

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A TEST PROCEDURE TO EVALUATE THE RELATIVE SUSCEPTIBILITY OF MATERIALS TO STRESS CORROSION CRACKING

Aerospace Corporation, Materials Sciences Laboratories. D. L. Dull, and L. Raymond. December 1972. 44 pages.

AD–754 205

Stress corrosion cracking (SCC) may be defined as a cracking process that requires the simultaneous action of a corrosive environment and a sustained stress. A number of test methods exist

Corrosion
(continued)

for the determination of the susceptibility of materials to SCC but much controversy surrounds the interpretation of the large scatter in the resultant time-to-failure data. A new stress corrosion test procedure, based on electrochemical potentiostatic polarization techniques, is presented in this report. The procedure provides a semiquantitative approach for SCC susceptibility testing, and it explains the data scatter observed with other techniques. A "potentiostatic stress corrosion curve" may be constructed from the test data which permits the prediction of the relative SCC behavior of materials in aqueous environments, and any accelerated failure times that result from the galvanic coupling of these materials to titanium and aluminum alloys.

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Metals and Alloys

PROPERTIES OF PREALLOYED STEEL POWDER METALLURGY PRODUCTS

Battelle Memorial Institute, Pacific Northwest Laboratories. R. E. Westerman, and K. R. Sump. December 1972. 144 pages.

AD–753 325

It is well known that products produced by conventional die press and sinter powder metallurgy fabrication techniques generally exhibit mechanical properties inferior to those of their wrought counterparts, because of the high concentration of pores within the bulk material. This problem can be minimized by employing fabrication procedures which lead to high densification. In the studies described in this report, test specimens of seven different major steel alloys were formed by die press and sinter process, isostatic press and sinter process, hot repressing (limited deformation forging), and high-energy rate forming (HERF). Commercial practice was closely adhered to, with no attempt being made to optimize any process. Tensile and impact property data, and the dependence of these values on fabrication and heat treatment parameters are presented. It was found that specimens fabricated by hot repressing and *HERF* exhibit tensile and impact properties far superior to cold pressing and sintering and equal to their wrought counterparts.

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A LITERATURE SURVEY OF THE COMBINED EFFECTS OF STRAIN RATE AND ELEVATED TEMPERATURE ON THE MECHANICAL PROPERTIES OF METALS

Brown University, Division of Engineering. Abdel-Salam M. Eleiche. September 1972. 131 pages.

AD–754 243

A compilation is provided of experimental data available in the literature on the combined effects of strain rate and elevated temperature on the mechanical properties of various metals and their alloys. The metals covered are aluminum, beryllium, copper, iron, lead, magnesium, molybdenum, nickel, niobium, and titanium. The data and reference sheets included in this document should be useful as a source of quantitative information on the rate dependence of the mechanical properties of metals, as well as a quick reference on the experimental investigations carried out to date in this field.

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NEW PROCESSING TECHNIQUES FOR ALUMINUM ALLOYS

Frankford Arsenal, Pitman-Dunn Laboratory. Jeffry Waldman, Harry Sulinski, and Harold Markus. October 1972. 40 pages.

AD–754 571

Recent work on upgrading the properties of high strength aluminum alloys through improved processing techniques is described. Among the results are the following: (1) Controlled solidification and homogenization techniques improve the mechanical properties of high strength aluminum alloys, especially in the short transverse direction; (2) new ingot processing techniques produce wrought aluminum alloy products that have a much finer grain size, significantly better ductility, and at least equivalent stress corrosion resistance to conventionally processed materials at equivalent strength levels; (3) a new thermal mechanical treatment that produces wrought high strength aluminum alloys that have a better combination of strength and ductility than is possible with conventional treatments. By using combinations of these techniques, new avenues of approach are available for producing aluminum alloys with superior engineering properties.

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ENGINEERING DATA ON NEW AEROSPACE STRUCTURAL MATERIALS. VOLUME I

Battelle Columbus Laboratories. O. L. Deel and H. Mindlin. September 1972. 118 pp.

AD–755 407

ENGINEERING DATA ON NEW AEROSPACE STRUCTURAL MATERIALS. VOLUME II

Battelle Columbus Laboratories. O. L. Deel and H. Mindlin. September 1972. 168 pages.

AD–755 408

Many of the materials developed for aerospace applications are potentially useful outside of this area. A major difficulty that design engineers encounter, particularly for new materials such as these, is lack of sufficient engineering data information to effectively evaluate the relative potential of these developments for a particular application. It is the purpose of these volumes, therefore, to provide comparative engineering data on a number of recently developed alloys, older alloys produced by new processing techniques, and new product forms of existing alloys. The data, which are presented largely in tabular and graphic form, include tension, compression, shear, impact, fracture toughness, fatigue, creep and stress rupture, stress corrosion, thermal expansion, and density. Volume I covers the following alloys: Steel 17-4 PH (Fe-15.9Cr-4.45Ni-3.45Cu) bar produced by electroslag remelting; nickel-chromium-cobalt alloy Udimet 710 forged bar; aluminum-zinc-magnesium-copper alloy 750-T7E56 hand forging; aluminum-copper alloy 2214-T351 plate; and Ti-6A1-4V Alloy diffusion bonded component. Volume II covers: Stainless steel 15-5 PH (Fe-15.14Cr-4.58Cr-3.32Cu); steel alloy 9Ni-4Co-0.20C; stainless steel PH 13-8 Mo (Fe-12.62Cr-8.24Ni-2.16Mo-1.02A1); aluminum alloy 7049-T76 extrusions; Ti-6A1-2Sn-4Zr-6Mo Alloy; nickel-chromium-aluminum alloy Inconel 702; and nickel-iron-chromium alloy Inconel 706.

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MAGNETIC ANALYSIS IN METALLURGICAL RESEARCH

Franklin Institute. John D. Blades, Victor V. Damiano, Eckard Kneller, and C. Domenicali. September 1967. 116 pages.

AD–823 511

The crystal structure, the impurities, the vacancy defect structure, and the elastic condition of a metal will determine its magnetic state, both dynamic and static. Because this direct relationship xists, magnetic analysis plays an important role in the fabrication, ontrol, and utilization of magnetic materials. The objective of this eport is to demonstrate in as simple a manner as possible the ctual process of magnetic analysis in metallurgical research that as led or might lead to successful technological applications of nagnetic metals. In the accomplishment of this objective the report rovides: An outline of research techniques and processes for the enefit of the novice; a review of some recent research in magnetic naterials; and a definition of new problem areas, which could be olved by utilizing various forms of these analytical techniques for nproved and/or new applications. Attention is also given to the nprovement of the formulation and standardization of the analycal processes to improve handling from laboratory to laboratory.

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HE METALLURGICAL UPGRADING OF AUTO-IOTIVE SCRAP STEEL

owa State University, Ames Laboratory. O. N. Carlson, and F. A. chmidt. September 1972. 62 pages.

S–EPA–1

efore it will be economically feasible to reclaim and recycle the eel from automotive scrap, methods for the removal or "neutraliation" of copper, tin, and chromium must be found. The reasons r this are metallurgical: copper and tin cause hot-shortness in eel during the rolling process; and all three metals suppress the ility of steel to be deep drawn. This document gives the results of the first phase of an effort to produce high quality steel from automotive scrap that will be acceptable to steelmakers and foundrymen who supply the large steel-consuming industries. A determination was made of the conditions necessary for the removal of copper, tin, and chromium from auto scrap steel using various methods of reduced pressure melting. The specific melting techniques examined were nonconsumable arc melting, elctron beam melting, vacuum arc melting, and vacuum induction melting. Also included was an investigation of the potential use of electroslag remelting as a method of consolidating and upgrading auto scrap. The latter appears to be the most promising of the methods studied, although additional work is necessary to achieve a commercially acceptable process.

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HYDROGEN IN STEEL

Monsanto Research Corporation, Mound Laboratory. K. F. Chaney. September 1967. 17 pages.

MLM–1355

This report reviews background information concerning the effects of hydrogen in steel. Consideration is given to adsorption and other surface phenomena, solubility, diffusion, other factors affecting permeation, isotope effect, and the deleterious effect of hydrogen in steel.

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MATERIALS DATA HANDBOOK. ALUMINUM ALLOY 5456 (2nd Edition)

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whittier. June 1972. 102 pages.

N72–30457

Aluminum alloy 5456 is a nonheat-treatable wrought alloy, first made available in 1956. It is one of the aluminum-magnesium group of alloys containing small additions of other elements. Typical areas of application are high strength welded structures, storage tanks, deck housings, overhead cranes, vehicles, and heavy duty structures. This handbook provides a summary of the materials property information presently available on the 5456 alloy. The scope of information presented includes physical and mechanical property data at cryogenic, ambient, and elevated temperatures, supplemented with useful information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented, and these data are complemented with information on the typical behavior of the alloy. The information is given in the form of tables and figures, supplemented with descriptive text as appropriate.

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MATERIALS DATA HANDBOOK. ALUMINUM ALLOY 6061 (2nd Edition)

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whittick. May 1972. 114 pages.

N72–30458

Aluminum alloy 6061 is a heat-treatable wrought alloy developed in 1931 as a general purpose structural alloy. The main alloying elements are magnesium and silicon, with small additions of other elements. This alloy is the most versatile of the wrought heat-treatable alloys. Typical areas of application include marine structures, machinery parts, aircraft fairings, large trailer bodies, screw machine products, architectural structures, and aircraft furniture. This handbook presents a summary of the materials property information presently available on the 6061 alloy. The scope of information presented includes physical and mechanical property data at cryogenic, ambient, and elevated temperatures, supplemented with useful information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented where available, and these data are complemented with information on the typical behavior of the alloy. The information is given in the form of tables and figures, supplemented with descriptive text as appropriate.

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MATERIALS DATA HANDBOOK. ALUMINUM ALLOY 7075. (2nd Edition)

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whittick. April 1972. 141 pages.

N72–30459

Aluminum alloy 7075 is a high strength, heat-treatable wrought alloy which was developed in 1943. The alloy contains zinc, magnesium, chromium, and copper as hardeners plus small additions of other elements. Typical areas of application are in aircraft structures, piping systems, mobile equipment, and high-pressure hydraulic units. This handbook presents a summary of the materials property information presently available on the 7075 alloy. The scope of the information includes physical and mechanical data at cryogenic, ambient, and elevated temperatures, supplemented with useful information in such areas as material procurement, metal-urgy of the alloy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented where available, and these data are complemented with information on the typical behavior of the alloy. Information is given in the form of tables and figures, supplemented with descriptive text where appropriate.

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MATERIALS DATA HANDBOOK. INCONEL ALLOY 718. (2nd Edition)

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whitlock. April 1972. 115 pages.

N72–30460

Inconel Alloy 718 is a wrought, age-hardenable nickel-chromium base alloy which was first introduced in 1959. This alloy was developed primarily for use at medium high temperatures, up to about 700 C, to fill a need for wrought material with good weldability. Its sluggish response to age hardening permits annealing and welding without spontaneous hardening during heating and cooling. This handbook provides a summary of the materials property information available on Inconel 718. The scope of the information includes physical and mechanical property data at cryogenic, ambient, and elevated temperatures, supplement with useful information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented where available, and these data are complemented with information on the typical behavior of the alloy. Information is given in the form of tables and figures, supplemented with descriptive text as appropriate.

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MATERIALS DATA HANDBOOK. ALUMINUM ALLOY 2219 (2nd Edition)

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whittick. March 1972. 149 pages.

N72–30461

Aluminum alloy 2219 is a heat-treatable wrought alloy developed in 1954 for applications at temperatures up to 315°C. Typical mechanical properties of 2219 in the 260°C — 315°C temperature range are superior to those of any other commercially available aluminum alloy. The weldability of the alloy is excellent. This handbook provides a summary of available materials property information on the 2219 alloy. The scope of the information includes physical and mechanical property data at cryogenic, ambient, and elevated temperatures, supplemented with useful information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented where available, and these data are complemented with information on the typical behavior of the alloy. The information is given in the form of tables and figures, supplemented with descriptive text where available.

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MATERIALS DATA HANDBOOK. STAINLESS STEEL ALLOY A–286

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whittick. June 1972. 109 pages.

N72–30463

Alloy A-286 is a precipitation hardening, heat-treatable, austenic stainless steel. It is designed for service at temperatures as high as 700°C for applications requiring high strength and good resistance to corrosion at operating temperatures, and for service at higher temperatures where applications are at lower stresses. The alloy is particularly attractive for applications as fasteners and springs for elevated-temperature service because of relatively low stress-relaxation or loss of load in operations. This handbook presents a summary of available materials property information on Alloy A-286. Its scope includes physical and mechanical property data at cryogenic, ambient, and elevated temperatures, supplemented with useful information in such areas as material procurement, metallurgy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented where available, and these data are complemented with information on the typical behavior of the alloy. Information is given in the form of tables and figures, supplemented with descriptive text as appropriate.

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MATERIALS DATA HANDBOOK. TITANIUM 6A1–4V

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whittick. May 1972. 124 pages.

N72–30464

Titanium 6A1-4V, which was first introduced in 1954, comes as close as possible to being a general-purpose titanium alloy. Typical applications of the alloy include aircraft structures, pressure vessels, chemical processing equipment, and food processing equipment. This handbook presents a summary of the available materials property information on Titanium 6A1-4V. Its scope includes physical and mechanical property data at cryogenic, ambient, and elevated temperatures supplemented with useful information in such areas as material procurement, metallurgy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented, and these data are complemented with information on the typical behavior of the alloy. Information is presented in the form of tables and figures, supplemented with descriptive text where appropriate.

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Miscellaneous Materials

MPROVED HIGH-TEMPERATURES SOLID FILM LUBRICANTS

Midwest Research Institute. Vern Hopkins, Melvin T. Lavik, and Ronald D. Hubbell. March 1970. 175 pages.

AD–867 391

Miscellaneous Materials (continued)

Solid lubricants have found widespread use in such applications as ball and journal bearings, DC motor brushes, and sliders. This document provides the results of work which was undertaken to develop and evaluate solid lubricants capable of satisfactory performance over a wider range of conditions than those currently available; that is over a range of temperatures extending from cryogenic to 2000°F, loads to 20,000 psi, and pressures from 10^{-7} to 760 torr. Development work was done with both hot-press compaction and ceramic bonding. The results have permitted an assessment of the relative advantages of solid lubricant films versus compacts for different applications. In addition, operational capabilities and limitations of the best materials over a range of conditions (temperature, load, speed, ambient temperature, and different atmospheres) have been defined. The lubricant evaluation was directed toward the determination of many different lubricant properties which will aid a potential user in the selection of a solid lubricating material for a particular application.

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TRENDS IN USAGE OF CORDAGE FIBERS

National Materials Advisory Board. November 1972. 82 pages.

PB–213 948

Abaca and sisal are two important cultivated vegetable fibers that are used currently in the manufacture of rope and twine. Essentially the entire world production of abaca is in the Philippines. Sisal is grown in many countries of the world, principally in Africa and Latin America. This document assesses the implications of technological change and usage trends on the supply/demand balance of these cordage fibers. Consideration is given to: The world production, availability, and price of natural cordage fibers and, also, that of man-made fibers; consumption of cordage fibers in rope products, twine fibers, paper industry, and wire-rope cores; projections on use of natural and man-made cordage fibers; structure and flexibility of the cordage industry; the impact of novel technology on the cordage industry.

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Plastics

DESIGN CRITERIA, TRANSPARENT POLYCARBONATE PLASTIC SHEET

Goodyear Aerospace Corporation. Richard S. Hassard. August 1972. 196 pages.

AD–751 551

Polycarbonate plastics of the bisphenol A Type (marketed under the trade names Lexan, Merlon, etc.) are transparent thermoplastics having high impact strength, good heat resistance, low water absorption, and good electrical properties. This report deals with test procedures for determining design criteria for polycarbonate sheet material. A complete test program is outlined. Consideration is also given the use of abrasion-resistant coatings and acrylic cladding as a means of improving the over-all properties of polycarbonate glazing.

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NOVEL BENZOBISTRIAZOLOPHENANTHRONE POLYMERS

Air Force Materials Laboratory. Robert C. Evers. June 1972. 23 pages.

AD–753 414

A novel, high molecular weight benzobistriazolophenanthroline polymer has been recently achieved which can be readily cast into tough, flexible films. The films have good heat resistance, with the onset of polymer breakdown occurring at about 450 C. The preparation and characterization of the polymer is described in this report.

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INVESTIGATION OF TECHNIQUES FOR FABRICATING PLASTIC OPTICAL COMPONENTS

University of Arizona, Optical Sciences Center. Stephen Blecher. August 1972. 53 pages.

AD–754 818

A large number of organic polymers are hard and transparent which, together with their light weight and low cost, makes them potentially useful for the fabrication of optical components. This report gives the results of a study of the feasibility of producing large (greater than 4 inch) plastic components of moderate precision (*i.e.*, surface accuracies on the order of one fringe per inch of diameter). It was found that such components may be successfully produced from thermoplastic and thermosetting materials by grinding and polishing. Compression forming also holds promise as a method for forming optical components from thermoplastics, but this process requires additional developmental work to give the required accuracy. A general discussion is included of the physical and optical properties of plastics, and comparison is made of the corresponding properties of glass.

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PLASTICS FABRICATION BY ULTRAVIOLET, INFRARED, INDUCTION, DIELECTRIC, AND MICROWAVE RADIATION METHODS

Plastics Technical Evaluation Center. Arthur F. Readdy, Jr. April 1972. 160 pages.

AD–756 214

The actual and possible uses of essentially non-ionizing radiation in the fabrication of plastics are surveyed. A greater portion of these modes of radiations have been used, at some level of sophistication, for many years. It is the purpose of this survey to re-emphasize to plastics fabricators that such processes exist and have been improved. It is shown that one or more of these non-ionizing radiation methods can often be employed advantageously. Gains can include one or more of the following in fabrication of plastic products: greater economy, increased processing

Plastics
(continued)

speed, improved end-item quality, higher degree of reliability or reproducibility, and enhanced performance under stringent use conditions. The materials or end-items to which non-ionizing radiation fabrication techniques can be applied include glass-reinforced polyesters (laminates, pipes, etc.), coatings and inks, formed sheets, thermoplastic bonded products, molded phenolics, epoxies and other thermosetting resins, urethane foams, foundry core binders, and rubber-like materials.

DEVELOPMENT OF NONFLAMMABLE CELLULOSIC FOAMS

Battelle Columbus Laboratories. Manfred Luttinger. July 1972. 31 pages.

N72–30501

This report describes the development of a series of moldable foams which have minimal friability and good flame resistance. The highest degree of flame retardance was exhibited in compositions containing urea-formalde foam, polyvinylidine chloride with latex binder, and cellulose treated with phosphoric acid-cynamid reagent. Frothing techniques for the materials are described. Although the work was motivated by the need for instrument storage cushions for use in manned aerospace systems, the foams appear to hold promise for the production of such items as ceiling tiles, wall board, etc.

AN ANNOTATED BIBLIOGRAPHY OF PYRRONE AND BBB PUBLICATIONS

Langley Research Center (NASA)
Harold D. Burks. December 1972. 67 pages.

N73–12608

Pyrone (polyimidazopyrrolone) and BBB (bis-benzimidazo-benzophenan-throline) are two relatively new polymeric materials with good stability at high temperatures. This bibliography provides abstracts of publications dealing with the chemistry and materials properties of these two related classes of polymer. The period covered dates from the first work with these materials, 1965, and extends through 1971. The subject matter includes thermochemical analysis, synthesis, copolymerization, physical properties, and processing into composites, fibers, films, foams, and moldings. A subject index is included.

Wood

REDUCING PARTICLEBOARD PRESSING TIME : EXPLORATORY STUDY

Department of Agriculture, Forest Products Laboratory. Bruce G. Heebink, William F. Lehmann, and F. V. Hefty. July 1972. 14 pages.

AD–750 010

The output of the hot press determines the quantity of particle board produced by a manufacturing facility. The variable which control this output are size of press and time the material is in the press, both of which are primary factors in equipment and production expenses. This report provides the results of work which was undertaken to develop basic information on the effects of several variable individually on the minimum time required in the hot press using uncatalyzed binders with and without uniform moisture distribution in the particle mat. The variables most effective in reducing presstimes were found to be higher press temperatures, fast press closing, and nonuniform mat moisture contents. By proper selection of variables, it was possible to produce an adequate ½-inch-thick board in as little as one minute presstime.

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TENSILE STRENGTH OF LUMBER LAMINATED FROM ⅛-INCH-THICK VENEERS

Department of Agriculture, Forest Products Laboratory. R. C. Moody. September 1972. 29 pages.

AD–751 087

It has been found that structural lumber manufactured by laminating ⅛-in-thick, relatively low grade, but-jointed veneer has tensile strength values significantly higher than the middle and lower grades of sawn structural lumber that might be obtained from the same type raw material. Furthermore, the laminates have considerably less specimen-to-specimen variability than sawn members. The use of such laminates, with their relatively high and consistant tensile strengths, will aid in the reliable design of wood structures and the efficient use of timber resources. This report summarizes the studies upon which these finding are based, and provides some design considerations which will help optimize the properties of the laminates.

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DETERMINING LOSS OF WOOD SUBSTANCE IN OUTSIDE CHIP STORAGE: A COMPARISON OF TWO METHODS

Department of Agriculture, Forest Products Laboratory. W. C. Feist, E. L. Springer, and G. J. Hajny. 1972. 11 pages.

AD–755 339

Pulpwood chips stored in outside piles are subject to microbiogical and chemical attack that cause losses in wood substance. Reliable, accurate methods for determining these losses in outside hip storage are economically significant; values for loss in wood ubstance can be combined with values for pulp yield to give verall loss in pulp yield based on unstored wood. This report describes and compares two methods for determining wood loss during outside storage. One method involves the determination of weight loss and the other involves the determination of loss in specific gravity. It is shown that either method can give satisfactory results if a sufficient number of initial and final samples are included.

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MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING

Aviation Facilities

LANDING FIELDS AND RUNWAYS. A DDC BIBLIOGRAPHY

Defense Documentation Center. October 1972. 160 pages.

AD–751 400

This bibliography contains abstracts of reports of U.S. Government funded research on aircraft landing fields and runways. The scope of the reports includes landing field and runway design, configuration, construction, pavement evaluation, paints and coatings, materials, maintenance, and repair. The reports were published during the period 1969 through early 1972. Subject, personal author, and corporate author indexes are included. All of the reports listed are available from NTIS.

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THE USER REQUIREMENTS FOR AN AIRFIELD PAVEMENT SYSTEM

Construction Engineering Research Laboratory. Joseph L. Pfeister. January 1973. 29 pages.

AD–753 927

Available literature on the subject of airfield pavements reveal that a number of researchers have attempted to list the desirable properties of airfield pavement and pavement surfaces. While these lists provide some insight into the pavements problem, they have not presented a comprehensive and systematic description of the user requirements for pavements. This report defines a functional index which may be used in evaluating the performance of airfield pavement systems. It presents a listing of pavement users and a set of quantified user requirements intended for use in an evaluation model.

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OPTIMUM RUNWAY ORIENTATION RELATIVE TO CROSSWINDS

George C. Marshall Space Flight Center. L. W. Falls, and S. C. Brown. September 1972. 19 pages.

N72–30250

Runway orientation is undoubtedly influenced by a number of factors—perhaps winds, terrain features, population interference, etc. In some cases, the frequency of occurrence of crosswind components of some significant speed may have received insufficient consideration. Two procedures for obtaining optimum runway orientation relative to minimizing a specified crosswind speed are

Aviation Facilities (continued)

described and illustrated in this document. One method, an empirical procedure, requires only hand calculations on an ordinary wind rose. The second, theoretical method utilizes wind statistics computed after the bivariate normal eliptical distribution is applied to a data sample of component winds. Both methods give satisfactory results.

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Bonding and Joining

ADVANCES IN JOINING TECHNOLOGY–THE '60s AND BEYOND

Battelle-Columbus, Metals and Ceramics Information Center. R. M. Evans. January 1973. 68 pages.

AD–754 262

There have been many changes in welding technology in recent years. New processes have been introduced, young processes have advanced greatly, and the old established processes have maintained pace through improvement. Each of these also has received aid from the major advancements made in process control, mechanization, and in better understanding of the origin of problems. This report describes what are believed to be the most significant advancements in welding technology that have occurred since 1960. The range of subjects covered include: Fusion welding processes (plasma-arc welding, electron-beam welding, gas-shielded welding processes, laser welding); resistance welding processes (spot-weld adhesive bonding, high-frequency welding, resistance welding process control); solid-state welding processes (friction welding, diffusion bonding, explosive welding); brazing (filler metal developments, fluxless brazing of aluminium).

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THE INTRODUCTION OF DISCONTINUITIES IN HIGH STRENGTH STEEL WELDMENTS

Construction Engineering Research Laboratory. K. W. Carlson, F. V. Lawrence Jr., and J. B. Radziminski. December 1972. 16 pages.

AD–755 524

The long-range effects of weld discontinuities on the mechanical behavior of joints is of serious concern in structure engineering, since rarely are weldments effected without some discontinuities such as cracks, porosity, lack of fusion, incomplete penetration, undercut, inclusions, burnthrough, or others. Consequently, techniques are sought for deliberately introducing discontinuities so that controlled studies can be made. An investigation is reported of the development of methods for consistently creating porosity slag inclusions, lack of fusion, and hydrogen cross-cracking in order to evaluate their effects on the properties of welds. The techniques used included both electrical and mechanical perturbations of the welding parameters. A discussion and comparison of methodologies is presented. This report is an addendum to AD–749 459 (See AMTID, April 1973, page 80).

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A GUIDE TO THE ADHESIVE MANUFACTURER'S LITERATURE

Dow Chemical U.S.A., Rocky Flats Division. James D. Navratil. November 1972. 47 pages.

RFP–1951

During the past three decades, adhesives to fasten materials together by surface attachment have developed to a point of great sophistication. Adhesives have been developed for use in extreme environments and for a variety of desired physical properties. Present usages of adhesives including bonding parts of aircraft, automobiles, buildings, footwear, industrial equipment, instrumentation, and packaging. This guide has been prepared to assist in the preliminary selection of adhesives for predetermined applications. It permits the selection of an adheisve type on the basis of adherends to be bonded and general physical characteristics. Final selection of the adhesive for testing may be made by consulting the respective manufacturers. A list of U.S. manufacturers, keyed to the specific adhesives manufactured, is included.

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Building Technology

SEISMIC DESIGN OF BUILDING STRUCTURES

University of New Mexico. J. T. P. Yao, C. Omid'varan, A. Gurpinar, and C. L. Hulsbos. July 1972. 150 pages.

AD–751 178

While it is not possible at present to prevent the occurrence of strong-motion earthquakes, continuous efforts have been made to improve the design of structures to minimize the earthquake damage to the structures. Existing specifications concerning earthquake loads provide a set of equivalent static lateral loads. This report is concerned with the formulation of possible improvements in code specifications for the seismic design of buildings. A survey of existing and available seismic design codes is provided. The "design tree" technique is used to summarize these specifications as well as to present possible improvements. The results of some original work on the application of discrete mechanics to structural dynamics are described. Reviews of the literature on statistical methods in earthquake engineering and on the seismic behavior of concrete and metal structures are also provided. A "direct approach" to seismic design codes is proposed which is expected to permit engineers to design building structures in a more precise, realistic, and economic manner.

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A COMPREHENSIVE COMPUTER-AIDED BUILDING DESIGN SYSTEM

Massachusetts Institute of Technology, Department of Civil Engineering. David G. Elms. June 1972. 67 pages.

PB–212 615

The digital computer is now widely used and accepted by all the professions involved in the process of building design. It is, however, still used in a fragmented way. This report presents a broad specification for a computer-aided building design system. The words "computer-aided" are used because the system is intended to be used as an aid to the design team rather than a wholly automatic design procedure. The report begins by discussing the nature of a building as a system. It then describes current design practice and shows why there is a need for a computer-aided design system. A structure is proposed for a computer-aided design system which is thought to be a workable and feasible scheme, and which show many of the information gaps existing in the design process. Finally, consideration is given to the implementation and research tasks which must be carried out before a cmoputer-aided design system can operate.

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STATIC AND EARTHQUAKE ANALYSIS OF THREE-DIMENSIONAL FRAME AND SHEAR WALL BUILDINGS

University of California (Berkeley), Earthquake Engineering Research Center. E. L. Wilson and H. H. Dovey. May 1972. 94 pages.

PB–212 904

Multistory and complex structured buildings have usually not been designed according to dynamic load analysis. Even in earthquake areas, construction codes have allowed seismic loads to be approximated by a static lateral loading. Interest is now being directed to improving the codes by design research, obtaining earthquake spectra, and understanding the interactions for foundation structures during seismic activity. It is felt that computer programs which might help can be better presented in a form convenient for direct application. The report aims to clarify some of these areas, in order to lead to more rational earthquake analysis methods. It develops a procedure and a computer program for the linear structural analysis of frame and shear wall buildings subjected to both static and earthquake loadings. Independent frame and wall elements are interconnected by floor diaphragms rigid in their own plane. Bending, axial, and shearing deformation are included. Three-dimensional mode shapes and frequencies are evaluated for three independent vertical and two lateral static loading conditions which may be combined with a lateral earthquake input.

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SOLID WASTE HANDLING AND DISPOSAL IN MULT-STORY BUILDINGS AND HOSPITALS. VOLUME I. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Engineering Services Corporation; and Greenleaf/Telesca, Engineers and Architects. 1972. 244 pages.

PB–213 132

SOLID WASTE HANDLING AND DISPOSAL IN MULT-STORY BUILDINGS AND HOSPITALS. VOLUME II. OBSERVATIONS OF LOCAL PRACTICE

Engineering Services Corporation; and Greenleaf/Telesca, Engineers and Architects. 1972. 301 pages.

PB–213 133

SOLID WASTE HANDLING AND DISPOSAL IN MULT-STORY BUILDINGS AND HOSPITALS. VOLUME III. RESEARCH ON SYSTEMS DEVELOPMENT

Engineering Services Corporation; and Greenleaf/Telesca, Engineers and Architects. 1972. 224 pages.

PB–213 134

SOLID WASTE HANDLING AND DISPOSAL IN MULT-STORY BUILDINGS AND HOSPITALS. VOLUME IV. SELECTION AND DESIGN OF SOLID WASTE SYSTEMS

Engineering Services Corporation; and Greenleaf/Telesca, Engineers and Architects. 1972. 189 pages.

PB–213 135

Problems of solid waste collection and disposal in institutions and other multistory buildings reflect many of the same problems confronting communities at large, but in greatly magnified form. In large building complexes solid waste systems are often extremely crude and inefficient. The rectification of this situation calls for a two phase approach: Immediate application of improved methods that are presently available, and then planning and research for optimal future solutions. This series of documents reflects this approach, and will hopefully motivate administrators and designers concerned with multistory complexes to consider solid waste handling and disposal as an integral factor in the total service system provided for these buildings. Volume I presents a digest of the development of systems evaluation methodology, and criteria for systems design, together with a summary of the contents of the entire four volumes. Volume II is a detailed study and evaluation of existing systems and practices in fifteen building complexes in Los Angeles County, California. Volume III covers an investigation and evaluation of available solid waste handling, storage, processing, and disposal equipment and systems adaptable to building installations. Volume IV provides an extended evaluation of systems adaptable to various classifications of buildings and complexes, with recommendations for operational improvements or modifications of existing systems as may be required in each type of facility.

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SYSTEMS BUILDING

American Society of Civil Engineers; and National Science Foundation. Kenneth F. Reinschmidt (Editor). February 1972. 346 pages.

PB–213 480

This documents is comprised of the proceedings of a conference, held in February 1972, on "systems building"—the systems approach to the building process. The first section is devoted to a case study of the planning, design, and construction of the Standard Oil of Indiana Building in Chicago. This presentation and discussion illustrates many of the conflicts, compromises, and decision process which are pertinent to the design and construction of a large building. Subsequent sections deal with: Project management approaches and techniques and their relation to systems building; evaluation of a decade of school building system developments; building codes and performance specifications; evaluation of building systems using performance criteria; formal and continuing education in systems building; future opportunities in systems building.

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Civil Engineering

In Situ TESTS FOR THE DETERMINATION OF ROCK MASS SHEAR STRENGTH

Army Engineer Waterways Experiment Station, Soils and Pavements Laboratory. T. W. Zeigler. November 1972. 209 pages.

AD–752 422

A reliable assessment of the shear strength of rock masses is often required to ensure a safe and economical design of many civil engineering projects. Since the shear strength of a rock mass is usually governed by the number, location, orientation, and physical properties of the geological discontinuities present in the mass, it is often quite difficult to determine this shear strength accurately. This report discusses methods of conducting various *in situ* field tests, such as direct shear tests, the triaxial or multiaxial tests, and the torsion shear test. Most of the discussion pertains to the direct shear test, since it has been found to be one of the most often used for field testing. The shear mechanism, test procedures and data interpretation are discussed for direct shear tests on clean and filled discontinuities, intact material, and concrete-on-rock contacts. Strengths determined from *in situ* shear tests reported in the literature are summarized.

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DEVELOPMENT AND EVALUATION OF A NEW EARTH EXCAVATOR

Foster-Miller Associates, Inc. August 1972. 119 Pages.

AD–752 567

In the field of earth excavation equipment there is a need for an efficient, continuous, maneuverable, self-contained top loader to utilize the advantages of efficient haul vehicles. This report describes the design, fabrication, model test, and scale-up of just such a device. The new excavator concept, which is essentially a novel combination of relatively conventional components, is designed around an assembly of forward-rotating, bucket-wheel type excavators and a curved scraper blade. Excavation wheel rotation is sufficiently fast so that the buckets excavate, carry away the soil, and provide tractive effort urging the scraper and vehicle forward. The scraper in turn provides a rear wall against which the buckets load, excavates additional material, and provides some hold-down force. Thus major excavation forces, thrusts or loads, are not required from external devices.

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A THEORETICAL AND EXPERIMENTAL STUDY OF TUNNEL BORING BY MACHINE WITH AN EMPHASIS ON BOREABILITY PREDICTION AND MACHINE DESIGN

Colorado School of Mines, Department of Mining Engineering. Fun-Den Wang, and Russell Miller. August 1972. 85 pages.

AD–754 143

The report discusses the results of a rockboring program for tunnel construction, involving linear cutting tests, the efficiency of various cutter types, and boring machine design. Model and full size tests were conducted for two linear rock cutting machine sizes. A main objective was the development of a full size machine. Laboratory tests were made on samples of rock from three different tunnels, the results of which are discussed. The performance of roller and pick type cutters is compared, including thrust, torque, specific energy and cutting coefficient. An extensive literature research provided much data on rock boring.

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ELECTROMAGNETIC PULSE SOUNDING FOR GEOLOGICAL SURVEYING WITH APPLICATION IN ROCK MECHANICS AND RAPID EXCAVATION PROGRAM

Ohio State University, Electroscience Laboratory. D. L. Moffatt and L. Peters Jr. September 1972. 111 pages.

AD–754 847

An important feature in hard rock tunneling technology is the detection of hazards in advance of rapid tunneling operations. The document covers progress in the development of an electromagnetic pulse sounding probe for the sensing and delineation of geological and man-made anomalies in an intended tunnelway. The results of theoretical studies are provided for types and arrays of wire antennas, spherical target fields, response waveforms, back scattered fields from subsurface targets, and optimized probe design. Successful measurements are described using one version of the electromagnetic probe on targets in a lossy overburden and in a limestone medium. The emphasis is on safety engineering.

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HOLE SPRINGING

Army Engineering Waterways Experiment Station, Explosive Excavation Research Laboratory. Richard H. Gillespie. June 1972. 33 pages.

AD–755 097

Two major factors contribute to the expense of an explosive excavation project: (1) the cost of the explosive, and (2) the cost of charge emplacement cavity construction. Typically, the latter cost is from three to six times the former, and represents the largest expense of an explosive excavation project. A possible method of reducing this cost is through the use of a technique called "hole springing." This involves enlarging the bottom of a drill hole to create a cavity for an explosive charge by successive detonations of small explosive charges. This report documents the design, implementation, and results of a series of hole springing tests in saturated weak coral, saturated clay shale, weathered granite, and interbedded sandstone and shale. During these tests varying techniques were used, and sizes varied from large, full cavity charges to small charges occupying a very small portion of the cavity. The measures of hole springing effectiveness were hole survivability, and the volume increase realized. The effects of the variables involved are discussed in detail.

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CRATERING IN LAYERED MEDIA

Duke University, School of Engineering
Aleksandar S. Vesic, Nabil M. F. Ismael, and Kul Bhushan.
December 1972. 44 pages.

AD–755 098

The ability to accurately predict cratering phenomena would be of great value in explosive excavation. Previous theoretical and experimental investigations of the mechanics of cratering have been concerned exclusively with craters formed in semi-infinite, homogeneous media. However, the actual crust of the earth is, of course, an essentially layered medium consisting of strata having different strengths and compressibilities. This report provides the results of model tests of creating in layered media, which were undertaken as a first step forward from considering cratering in semi-infinite, homogeneous media. These results are shown photographically and diagrammatically, and the generalizations that is possible to draw from the experiments are discussed.

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THERMAL MONITORING OF GEOLOGICAL CHANGES DURING EXCAVATION

Bendix Research Laboratories. H. K. Lintz. October 1972. 63 pages.

AD–755 117

Prediction of hazardous changes in lithology ahead of tunnels in hard rock during rapid excavation is based on the correlation of rock thermal properties with lithological change, showing up in displacement of the rock wall isotherms. The changes in hard rock to be predicted are intrusions, fault zones, water courses, and gas seepage or geothermal sources. A report is made on the feasibility of hazard prediction using a radiometer. Some uncertainties are discussed, involving machinery heat, excavation heat, and moisture on the rock. A number of tests are described, noting the effects of blasting, ventilation in drifts, and radiation properties. From a mathematical study and the experimental findings, some conclusions are drawn and effectiveness is compared with that of other methodology.

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DEVELOPMENT OF A REPETITIVE EXPLOSION DEVICE FOR ROCK FRACTURING

Southwest Research Institute. J. W. Colburn, Jr. and R. J. Mathis. December 1972. 56 pages.

AD–755 545

A high-efficiency earthmoving concept called REDSOD (Repetitive Explosion Device for SOil Displacement) was described in an earlier report (see AD-736 348 in AMTID, October 1972, page 46). This document concerns an extension of this concept to a device which can be used to augment the rock-fracturing capabilities of a standard Caterpillar tractor. The operating cycle of the REDSOD Rock Ripper, as the device is called, is as follows: As a ripper tooth begins penetration of a rock formation, a combustion chamber is charged with a mixture of compressed air and hydrocarbon fuel; as the load on the ripper tooth increases, the mixture is ignited with a spark plug; the resultant high-pressure gas is released through an orifice near the ripper tooth; the gas is forced into the bedding planes, joints, etc. of the rock, thus fracturing the rock. The cycle can be repeated every few seconds by the operator's command. The design of the REDSOD Rock Ripper is described, and the results of tests of the ripper at various limestone test sites are discussed.

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INVESTIGATIONS OF TECHNIQUES IN EXPLOSIVE DRILLING

AAI Corporation. W. L. Black. February 1973. 74 pages.

AD–755 929

Explosive drilling is a substitute for drill bit technology in boring holes in rock or soil. Detonation of a series of small explosive charge pulverizes the rock at the bottom of the bore hole, sinking large increments of hole without withdrawal of a drill stem to change bits. The method appears attractive because of reduction in the time lost in tool transit. The principal problem lies in introducing the explosives into the bore hole safely, and effectively conveying the spoil to the surface. The report covers explosive capsule and firing train design, feeder provisions, the drill rig configuration development tests, and some explosive drilling experiments.

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TECHNOLOGY AND ECONOMICS OF UTILITY TUNNELS AND COMMON TRENCHING

Oak Ridge National Laboratory (AEC), Urban Technology Group. W. J. Boegly, Jr., and W. L. Griffith. 1972. 19 pages.

CONF–720925–3

In urban areas, expansion of existing utility systems and the possibility of installing additional utilities such as central heating and cooling, solid waste collection systems, and pneumatic mail delivery systems, will produce increased competition for the available installation space. Two possible solutions to the problem are the use of tunnels to accommodate existing and future utilities, and the common installation of multiple utilities in the same trench. The utility tunnel, if properly designed, offers the potential for installation and maintenance of underground utilities without further excavation. However, this type of installation is more costly than conventional methods. Common or joint trenching presents many of the same problems as the utility tunnel. Its main advantage appears to be the reduction in the amount of excavation required and the potential for a minimum disruption of the surface.

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DEMONSTRATION OF A TECHNIQUE FOR LIMITING THE SUBSIDENCE OF LAND OVER ABANDONED MINES

Johnson-Fermelia and Crank, Inc.; Candeub, Fleissig and Associates; and Gordon E. Howard, Consultant. June 1971. 90 pages.

PB–212 708

After mining operations have been terminated, and a mine is abandoned, the void which remains can constitute a source of damage to surface structures and improvements. In an urban area surface subsidence into this void may bring disaster to the community and its property owners. The document reports on a demonstration project which was initiated in the expection that some of these gaps might be filled by employing a new hydraulic backfilling technique. The Rock Springs demonstration of the technique was programmed to completely fill an inaccessible, inundated mine void within a radius of 225 feet of a single injection hole. The site was particularly noteworthy because the area was already suffering from subsidence damage, and thus a practical assessment could be made of the costs and benefits in a damaged community. The findings, conclusions and recommendations of a successful demonstration project are presented and discussed.

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GUIDELINES FOR EROSION AND SEDIMENT CONTROL PLANNING AND IMPLEMENTATION

State of Maryland, Department of Water Resources; and Hittman Associates, Inc. Burton C. Becker and Thomas R. Mills. August 1972. 243 pages.

PB–213 119

This set of guidelines is primarily intended to help those responsible for, or engaged in, urban construction to prevent the uncontrolled movement of soil and the damage that it causes. It can provide guidance in the design and implementation of a complete sediment and erosion plan; it can also serve as a primer for those interested in this field. The various sections describe how a preliminary site evaluation determines what potential sediment and erosion control problems exist at a site being considered for development; give guidelines for the planning of an effective sediment and erosion control plan; and provide procedures for the implementation of that plan during operations. A cross-index and a glossary of relevant technical terms are provided.

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GENERALIZED SLIDING WEDGE METHOD FOR SLOPE AND EARTH PRESSURE ANALYSIS

University of Kentucky, Department of Civil Engineering. Vincent P. Drnevich. December 1972. 21 pages.

PB–214 254

Slope failures and failures of retaining walls and braced excavations often cause extensive damage. As a consequence, engineers today are trying to minimize the chances of such failures by performing more extensive soil investigations and stability analysis. A method of slope stability analysis is discussed in this document that can be used for rather complicated soil conditions and failure surfaces. It is known and used by many soils engineers and the calculations are usually made by hand or with the aid of a hand calculator. The main contribution of this document is to generalize the method to allow practically any possible failure surface to be analyzed and to extend the method to cover effective stress conditions where excessive pore exists. The method remains simple, inexpensive, and easy to use. Details of the method are described, several examples are given, and some limitations and cautions are discussed.

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RESONANT FOOTING TEST

University of Kentucky, Department of Civil Engineering. David Ding-Jung Pang. November 1972. 169 pages.

PB–214 312

Development of comprehensive stress-strain relations for soils is important to the design of pavements, earth dams, embankments, underground structures, and building foundations, but the technical evaluation of soil properties has not kept pace with analytical design technique. Determination of the shear modulus of soil is a critical feature needing improvement. A new technique is reported for measuring soil shear modulus, involving the use of resonant footing tests. By measuring the resonant frequency of a torsionally vibrating circular footing placed on an elastic half space, the shear modulus of the half-space, or soil medium, can be obtained. Details of the theory and the apparatus for the new testing method are described. In order to learn about the shear modulus of compacted soils, a series of triaxial column tests was conducted, after which a correlation was made between the torsional footing test values and those from the resonant column tests. A mathematical expression is derived and discussed.

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Computers

COMPUTER OPTIMIZATION OF MACHINING CONDITIONS FOR SHOP PRODUCTION

Pennsylvania State University, Department of Industrial Engineering. Inyong Ham. October 1972. 87 pages.

AD–754 569

Though computer assisted systems, such as numerical control and adaptive control, can greatly increase the efficiency of material removal operations, there is still need for improvement in the economics of these industrial operations. This report shows how optimization methods employing the computer can reduce costs by finding the most effective machining conditions for a given production objective. Described are two computer methods for analyzing optimum cutting conditions. Both are designed to determine from actual production data the best combination of machining parameters in relation to minimum cost per piece, maximum production rate, or maximum profit rate. Input to the computer programs if expressed in ordinary machining terms, and the functional engineering decisions are incorporated in the program design. The primary advantage of these methods is that they can easily provide information that has heretofore been difficult or impossible to obtain in the manufacturing plant. It is a further advantage that the output of the computer programs is in the form of printed instructions and tables, immediately ready for use by plant personnel.

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AN ANNOTATED AND CROSS-REFERENCED BIBLIOGRAPHY ON COMPUTER SECURITY AND ACCESS CONTROL IN COMPUTER SYSTEMS

Ohio State University, Computer and Information Science Research Center. Jeffrey G. Bergart, Marvin Denicoff, and David K. Hsiao. November 1972. 61 pages.

AD–755 225

The subject of privacy protection and access control in computer systems is concerned with effective means to protect the anonymity of private information on the other hand. This bibliography is comprised of critical abstracts of carefully selected publications in the field, and an analysis of the state of the art based on these publications. An attempt is made to show how one piece of work is related to or influenced by another, since research works seldom evolve without interaction. The abstracts are organized into four sections: Access control, computer security, business and management considerations, and social and legal implications.

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COMPUTERS IN INFORMATION SCIENCES: ON-LINE SYSTEMS

Defense Documentation Center. January 1973. 232 pages.

AD–755 700

This bibliography is comprised of abstracts of government-funded reports dealing specifically with the role of on-line computer systems. General materials include data processing and transmission, cathode ray tube screens and display consoles, computer programs, programming languages and computers, and information retrieval. A few specific coverages include multi-access, input-output devices, mathematical models, computer graphics, algorithms, bionics and artificial intelligence, management information systems, and allied topics. Indexes are included.

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COMPUTERS IN INFORMATION SCIENCES: TIME SHARING

Defense Documentation Center. February 1973. 426 pages.

AD–755 800

This bibliography is comprised of abstracts of reports resulting from U.S. Government-funded research on time sharing computers as utilized in the information sciences. General materials include data processing and transmission systems, digital, analog-digital, and special purpose computers, data storage systems, and computer storage devices. Particular topics include on-line systems, programming languages, remote control and input-output systems, man-machine and display systems, algorithms, multiplexing and multiprogramming, logic circuits, computer privacy, computer graphics, information retrieval, light pens, artificial intelligence, legal aspects, symposia, hardware and software, queueing theory and mathematical models, subroutines, optimization, computer aided instruction, computerized simulation, information systems, terminal engineering, errors, and allied data. Indexes are included.

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Electronics and
Communication
Technology

PACKAGED CIRCUITS. A DDC BIBLIOGRAPHY

Defense Documentation Center. November 1972. 154 pages.

AD–752 400

This bibliography contains selected abstracts of the report literature which has been generated as a result of U.S. Government-funded research on packaged electronic circuits. The scope of this literature includes principles and techniques of integration and packaging of printed circuits, packaging concepts for uncased integrated systems, and advanced electronic packaging techniques. The reports were published during the period 1954 through mid-1972. Subject, author, and report number indexes are included. All of the reports listed are available from NTIS.

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PROCEEDINGS OF THE TWENTY FIRST INTERNATIONAL WIRE AND CABLE SYMPOSIUM, DECEMBER 1972

Army Electronics Command. December 1972. 384 pages.

AD–752 908

This document is comprised of 42 papers which were presented at the symposium on electrical wire and cable, held 5-7 December 1972 in Atlantic City, New Jersey. The range of subject areas covered includes: Special cables for marine applications and advanced transmission systems; environmental effects and protection of telephone cables; wire materials and terminations; cable manufacturing methods; communication cable and sheath design; coaxial and multiconductor cable; cable materials.

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INTERACTIVE TELEVISION–PROSPECTS FOR TWO-WAY SERVICES ON CABLE

Rand Corporation. Walter S. Baer. November 1971. 102 pages.

PB–212 663

Cable television has evolved over the past two decades as a distributor of conventional television programming. Information on the cable now usually flows one direction—from the broadcaster or a community-type antenna to the user. The technology exists, however, to provide interactive, two-way communication services over cable networks. This report discusses the prospects for the development of this form of communication; the technical, economic, and regulatory forces that influence it; and the public policy issues that it raises. Consideration is given to a detailed description of potential services; the near-term economics of this group of services; recent field tests and demonstrations; and questions of policy such as technical standards and user privacy.

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A MICROWAVE TECHNIQUE FOR DETECTING AND LOCATING CONCEALED WEAPONS

U.S. Department of Transportation, Transportation Systems Center. R. M. Weigand. December 1971. 44 pages.

PB–213 323

In recent years the hijacking of commercial passenger aicraft has become a matter of international concern. The serious threat to public safety has generated a move to screen boarding passengers for the detection of concealed weapons. The report discusses the use of a scanning microwave reflectivity of concealed metallic weapons against the lower microwave reflectivity of human body tissues. Thus a complete search of the passenger is not required. An evaluation is made of a technique in which persons subjected to search are not exposed to objectional radiation, a simple threshold detector is used which obviates complex signal system processing, operation requires minimal training, and high resolution permits location of a suspected weapon. Several areas requiring continued experimental evaluation are identified.

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TOWARDS IMPROVING U.S.-LATIN AMERICA TELECOMMUNICATIONS RELATIONS

Teleconsult, Inc. October 1972. 230 pages.

PB–214 619

Present relationships between U.S. and Latin American telecommuncation policy level institutions are reviewed in this report. On the basis of this review, recommendations are offered concerning appropriate initiatives for establishing substantive and continuing relations with institutions and individuals responsible for policies, regulations, and ITU relationships. The first section gives a sketch of relevant historical events in U.S.-Latin American telecommunications relations. This is followed by the results of a survey of current conditions of Latin American telecommunications conditions. A brief review of manufacturing capabilities and current practices in frequency management is included. The next section deals with all important international and national, political, technical, and financing institutions which have direct impact upon telecommunications development in Latin America. Finally, a series of concrete suggestions is provided which are directed toward the achievement of effective and harmonizing working relations between the U.S. and Latin American authorities in telecommunications affairs.

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Environmental
Technology

PREDICTION OF EXHAUST EMISSIONS FROM PRIME MOVERS AND SMALL HEATING PLANT FURNACES

University of Illinois, Department of Mechanical and Industrial Engineering. S. C. Sorenson, J. J. Stukel, and W. L. Hull. July 1972. 109 pages.

AD–749 457

In the past few years, a substantial amount of information has been generated and published concerning the nature and quantity of emissions from internal combustion engines and small heating plant furnaces. This report provides a means for designers to make use of this type of information to predict the constituents of exhaust gases from diesel and gasoline engines, gas turbines, and heating plant furnaces under various load conditions and using various fuels. A correlation of the results obtained from a survey of available emission data made it possible to develop a series of models for specific pollutants. The pollutants involved are oxides of nitrogen, hydrocarbons, carbon monoxide, carbon dioxide, sulfur dioxide, and particulates. The models reflect: Equipment design; equipment operating procedures; and the age and condition of the equipment. The results from these models are used in other models to actually predict the ambient pollution levels created by each item of equipment. An extensive bibliography of the relevant literature is included.

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TRANSPORTATION AIR POLLUTANT EMISSIONS HANDBOOK

Argonne National Laboratory, Center for Environmental Studies. T. D. Wolsko, M. T. Matthies, and R. E. Wendell. July 1972. 187 pages.

ANL/ES-15

Air is polluted as a result of combustion, and the majority of transportation systems today use the combustion of fossil fuels as their main source of energy. The first step in determining the extent of the direct impact of transportation systems on air quality is to identify the emissions by transportation vehicles of the airborne pollutants which degrade the air quality this document describes a procedure that can be used to quantify such air pollution emissions. It contains background information, emission data, computer program descriptions, and manual calculation procedures which are intended to enable persons not familiar with air pollution problems from transportation sources to quantify the emissions.

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SIMPLE METHODS OF CALCULATING DISPERSION FROM URBAN AREA SOURCES

National Oceanic and Atmospheric Administration, Air Resources Atmospheric Turbulence and Diffusion Laboratory. Steven R. Hanna. April 1971. 27 pages.

COM–72–10999

A need exists for methods of calculating dispersion from urban area air pollution sources. Pollutants are emitted fairly uniformly from the surface of a city, in contrast to the emissions from large point sources such as electric power plants. A simple but physically realistic model is presented which has been shown to be adequate for estimating long-term pollutant concentrations due to area sources in cities. The model performs nearly as well as much more complex models that require the use of digital computers. A simple geometric model is also given for estimating long-term average pollutant concentration in the rural areas adjacent to cities.

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MULTIDISCIPLINARY STUDIES OF THE SOCIAL, ECONOMIC, AND POLITICAL IMPACT RESULTING FROM RECENT ADVANCES IN SATELLITE METEOROLOGY. VOLUME ONE

University of Wisconsin Space and Engineering Center. Verner E. Suomi, Delbert D. Smith, Gene E. Willeke, *et al.* June 1971. 476 pages.

N72-32974

MULTIDISCIPLINARY STUDIES OF THE SOCIAL, ECONOMIC, AND POLITICAL IMPACT RESULTING FROM RECENT ADVANCES IN SATELLITE METEOROLOGY. VOLUME II

University of Wisconsin, Space Science and Engineering Center. Verner E. Suomi, Delbert D. Smith, Kenneth R. Smith, *et al.* June 1971. 449 pages.

N72-32975

These volumes provide interim results of a continuing study which is being undertaken to explore and evaluate the impact of the meteorological satellite and the concomitant impact of the data derived from it on various user groups. Volume One contains case studies on the impact of satellite meteorology on natural resource utilization, agriculture, and commercial activities (highway construction, home construction, trucking, etc.). Also included are a number of complete papers on the following topics: International legal impact resulting from recent advances in satellite meteorology; impacts on water resources management; and the impact of accurate one-week weather forecasts, provided by satellite, on the demand for outdoor recreation. Volume Two is comprised of papers dealing with the following topics: The nature and impact of the benefits of improved satellite weather forecasts on agriculture; the nature of the impacts on various horticultural crops resulting from recent advances in satellite meteorology; role of technical language and communication systems in disseminating meteorological information to users; highway benefits due to the impact of satellite meteorology; nature of the impact on single-family home construction of satellite meteorology; impact on the common carrier trucking industry.

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REGIONAL MODELING ABSTRACTS. VOLUME I

Oak Ridge National Laboratory (AEC). Charles R. Meyers, Jr. October 1971. 214 pages.

ORNL–NSF–EP–7

REGIONAL MODELING ABSTRACTS. VOLUME II

Oak Ridge National Laboratory (AEC). Charles R. Meyers, Jr. December 1971. 310 pages.

ORNL–NSF–EP–10

REGIONAL MODELING ABSTRACTS. VOLUME III

Oak Ridge National Laboratory (AEC). Charles R. Meyers, Jr. June 1972. 331 pages.

ORNL–NSF–EP–23

Regional modeling may be defined as the technique of assessing the present status and predicting the future status of the economic, ecologic, and social environment for a given geographic region. A regional model is a synthesis of concepts developed by workers in various disciplines. Because of the breadth and scope of regional modeling, the researcher in this field must rely on a diverse literature from a number of diffuse sources. Thus, these compilations of abstracts seek to provide a reference source for this purpose. They cover the literature on all aspects relating to the development and use of models capable of simulating the economic, demographic, societal, ecological, and land use responses of a region to alternative policy decisions. Access to the abstracts is achieved through subject, author, and permuted title indexes.

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AFTERBURNER SYSTEMS STUDY

Shell Development Company. R. W. Rolke, R. D. Hawthorne, C. R. Garbett, E. R. Slater, T. T. Phillips, and G. D. Towell. August 1972. 512 pages.

PB–212 560

Afterburners or fume incinerators can be used to control the emission of gaseous or small particulate air pollutants which are combustible or thermally decompose at high temperatures. Most applications have been for the abatement of smoke, odor, and smog producing hydrocarbons. A systems study of afterburner technology for stationary emission sources has been undertaken, and the results are given in this report. The scope includes an evaluation of current engineering technology, evaluation of existing afterburner systems, assessment of present practices and problems, determination of major emission sources and potential applications, and the development of research recommendations. The main results of the study are presented in the form of a handbook of afterburner technology which should be useful both to equipment manufacturers and afterburner operators.

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FIELD OPERATIONS AND ENFORCEMENT MANUAL FOR AIR POLLUTION CONTROL. VOLUME I: ORGANIZATION AND BASIC PROCEDURES

Pacific Environmental Services, Inc. Melvin I. Weisburd. August 1972. 259 pages.

PB–213 008

FIELD OPERATIONS AND ENFORCEMENT MANUAL FOR AIR POLLUTION CONTROL. VOLUME II: CONTROL TECHNOLOGY AND GENERAL SOURCE INSPECTION

Pacific Environmental Services, Inc. Melvin I. Weisburd. August 1972. 391 pages.

PB–213 009

FIELD OPERATIONS AND ENFORCEMENT MANUAL FOR AIR POLLUTION CONTROL. VOLUME III: INSPECTION PROCEDURES FOR SPECIFIC INDUSTRIES

Pacific Environmental Services, Inc. Melvin I. Weisburd. August 1972. 472 pages.

PB–213 010

This manual presents field surveillance and enforcement tech- iiques that can be applied by air pollution control organizations o meet ambient air quality objectives. Inspection and enforcement echniques are described to reflect current air pollution control echnology and specified sources of air pollution. It is intended s a guide for air pollution control organizations in carrying out heir responsibilities in field surveillance, facility inspection, emis- ion source evaluation, and enforcement activities. Volume I deals vith: Sources and classification of pollutants; meteorological in- luence of air quality; the air pollution control organization; the ield enforcement officer; the enforcement processes; and inspec- ion techniques including plume evaluation, collection of evidence, andling of complaints, and operation of field equipment. Volume I covers: (1) The technology of source control, including the nodification of operations causing pollution, specific types of air ollution control equipment, sulfur dioxide removal systems for ower plants, and control equipment for gases and vapors; and 2) Inspection procedures for general sources, including fuel- urning equipment, incinerators, open burning, odor detection nd evaluation, and motor vehicle visible emissions. Volume III eals with inspection procedures for specific sources, these being: raft pulp mills, animal rendering, steel mills-furnaces, coking op- rations, petroleum industry, chemical plants, primary and second- ry non-ferrous smelting and refining, ferrous and non-ferrous foundries, cement plants, aluminum reduction plants, mining, coal preparation plants, fertilizer industry, paint and varnish manufacturing, galvanizing operations, roofing plants—asphalt saturators, and asphalt concrete batching operations.

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COMPUTER MODELING OF TRANSPORTATION-GENERATED AIR POLLUTION: A STATE-OF-THE-ART SURVEY

U.S. Dept. of Transportation, Transportation Systems Center. Eugene M. Darling Jr. June 1972. 134 pages.

PB–213 013

Growing concern for preservation of environmental quality has led to legislation aimed at curbing the impact of transportation-produced air pollution on the environment. Compliance with these laws calls for techniques to analyze such pollution. The report is a state-of-the-art survey of models for predicting the dispersion of transportation emissions. Actual working models are discussed, with a detailed treatment of computation methodology, and validations are critically assessed. Deficiency in validation is noted as the result of lack of instrumented test sites, and improvement is observed. Information includes emission sources and products, types of models along with their input, software, hardware, and output; and applications of the models. Some conclusions are also presented.

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NOISE POLLUTION

Oregon State University. Robert M. Alexander. May 1972. 20 pages.

PB–213 021

Noise is defined, in acoustics, as unwanted or disturbing sound. When noise reaches such a level that it interferes with one's well-being or emotional balance, it is as much a pollutant of the environment as a noxious gas or a toxic solid or liquid. Like air and water pollution, noise pollution effects are most profound in urban areas, created by traffic, airports, factories, and construction. The report presents some background information on the nature of sound and noise and various relations to people and communities. It deals with such obvious concerns as hearing loss, and with the subtler psychological and physiological effects. A brief review is given of national, state, and local legislation.

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STATE OF THE ART FOR CONTROLLING NO_x EMISSIONS. PART I. UTILITY BOILERS

Catalytic, Inc. L. K. Jain, E. L. Calvin, and R. L. Looper. September 1972. 118 pages.

PB–213 297

Utility boilers fired by gas, oil, or coal may contribute a significant amount of nitrogen oxides to the atmosphere. This document examines the state of the art of controlling this source of air pollution by combustion modification. Consideration is given to the equilibrium and kinetics of nitrogen oxide formation; factors effecting utility boiler emissions; combustion operating modification through load reduction, low excess air firing, load reduction with low excess air, two-stage combustion with low excess air and/or reduced load, reduced preheat temperature, steam and water injection, and fuel substitution; combustion equipment design modification; and flue gas treatment. A bibliography of relevant literature is included. (Part II of this series is not yet available.)

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ENVIRONMENTAL HEALTH PLANNING

Department of Health, Education, and Welfare, Bureau of Community Environmental Management. Robert E. Novick, Gary L. Beard, Clarence E. Clabert, *et al.* 1971. 135 pages.

PB–213 375

During this century, many activities designed to offset some of the consequences of man's impact on environment have developed. Most often conducted by regional or local public health agencies, these activities have been grouped together under the label "Environmental Health". This manual is intended to guide environmental health planners and managers in development of appropriate and effective programs through systematic planning—either for the development of new programs or the evaluation or upgrading of existing ones. The first section of the manual provides basic planning information, while subsequent sections discuss special considerations relating to planning programs in each of the environmental health areas. The latter include: Air quality; water quality; solid wastes; radiation; noise; disease vectors; pesticides; residential environment; public institutions; accidental injuries; occupational health; recreation; food; drugs; therapeutic devices; and cosmetics; and other problems.

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RECOMMENDED STANDARDS FOR SANITARY LANDFILL DESIGN, CONSTRUCTION, AND EVALUATION – AND MODEL SANITARY LANDFILL OPERATION AGREEMENT

National Solid Wastes Management Association; and U.S. Environmental Protection Agency. 1971. 25 pages.

PB–213 472

A sanitary landfill is an engineering method by which solid wastes are disposed of by compaction to minimal volume, spreading in thin layers, and covering with earth so as to minimize environmental pollution. Such a landfill is an acceptable and recommended method far superior to open burning dumps, although sound planning and careful construction are essential. Although nearly all topographies are feasible, varying land formations require individual techniques for individual sites. The report suggests features and procedures for accomplishing a good sanitary landfill operation in general. An evaluation is considered in two sections: requirements for a practicable landfill, and items in overall operation which must be judged from local conditions. A few major topics are site design, mapping, access and barriers, litter control, hours of operation, operating equipment, personnel, and construction methodology.

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ODORS AND AIR POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS

Environmental Protection Agency, Air Pollution Technical Information Center. October 1972. 263 pages.

PB–213 733

A compilation of abstracts of publications dealing with odors as they relate to air pollution is presented. The abstracts are arranged according to the following categories: Emission sources, control methods, measurement methods, air quality measurements, atmospheric interaction, basic science and technology, effects on human health, effects on plants and livestock, effects on materials, economic effects, standards and criteria, legal and administrative aspects, and social aspects. Subject and author indexes are included.

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MERCURY AND AIR POLLUTION: A BIBLIOGRAPHY WITH ABSTRACTS

Environmental Protection Agency, Air Pollution Technical Information Center. October 1972. 65 pages.

PB–214 011

This document is comprised of abstracts drawn from the world's literature concerning the air pollution aspects of mercury. The abstracts are arranged according to the following categories: Emission sources, control methods, measurement methods, air quality measurements, atmospheric interaction, basic science and technology, effects on human health, effects on plants and livestock, standards and criteria, legal and administrative aspects, and social aspects. Subject and author indexes are included.

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GUIDELINES FOR LOCAL GOVERNMENTS ON SOLID WASTE MANAGEMENT

U.S. Environmental Protection Agency. Patricia M. McDonough, Bambridge Peterson, and Aliceann Fritschler. 1971. 194 pages.

PB–214 039

This document is comprised of a set of ten guides which are intended to assist local policy making officials with problems involving the management of solid wastes. The guides are designed to present in clear, concise form information to help make decisions on the planning, organization, financing, staffing, legal aspects and operation of comprehensive areawide solid wastes management systems. A large number of bibliographic entries are included, each with the address where the publication may be obtained and its price, if known.

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INTEGRATED PEST MANAGEMENT

Council on Environmental Quality. November 1972. 51 pages.

PB–214 173

Pesticide use has contributed to the control of several major pests
and has led to increased rates of food and fiber production. But
the accumulation of pesticides in the food chain, the possible re-
duction in the populations of some fish and wildlife, and the po-
tential threat to man's health posed by some pesticides have shown
the need to seek new methods of pest control to supplement cur-
rent practices. This report deals with a group of such methods, col-
lectively known as integrated pest management. It focuses on forest
and agricultural pests with emphasis on insect pests and, to a lesser
xtent, weed control. The continuing need for pest control is dis-
cussed, and a description is given of current pest control practices
and some unforeseen consequences of these practices. The fun-
damental concepts of integrated pest control are then discussed,
vith examples of its successful application. The major techniques
vhich can be used as part of an integrated pest management pro-
ram are described. These include genetic control, metabolic con-
rol, and environmental control, as well as the use of parasites,
redators, microbial agents, and sterilization.

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ONSERVACION DEL MEDIO AMBIENTE FISCO Y L DESARROLLO (ENVIRONMENT AND EVELOPMENT)

nstituto Centroamericano de Investigacion y Technologia Indus-
rail; and U.S. National Academy of Sciences. July 1971. 235
ages.

B–217 119

his document contains the papers presented at the first Central
merican Workshop on Development and the Environment, held
t Antigua, Guatemala, 25-30 July 1971. The workshop was or-
anized for the purpose of examining in depth the regional en-
ironmental problems, and of providing planning directors and
overnmental officials with the necessary criteria for incorporating
nvironmental aspects into development programs. Twelve of the
apers are in Spanish with English summaries; five are in English
ith Spanish summaries. The topics covered are: La problacion de
entroamerica y sus perspectivas; tensiones en el desarrollo y los
oblemas del medio ambiente; el potentcial industrial dentro del
ercado Comun Centroamericano; proteccion ambiental en una
onomia en desarrollo; el transporte y otras industrias de ser-

Environmental Technology
(continued)

vicios; el turismo; el potencial agricola en los paises del Mercado Comun Centroamericano; conservacion de suelos y control de inundaciones; el regadio, su influencia en al ambients fisico y resultados que se derivan de su manejo racional; Los pesticidas en relacion con el medio fisico, la ocupacion y el crecimiento del ingreso; plant and animal breeding; forestry potential and its development in Central America; conservacion y proteccion de la biota; regional and urban planning for national development; a mathematical model for environmental analysis; development, the environment, and information; el medio ambiante fisico y la educacion. (A summary report of the workshop, in English, is also available; see the January 1973 issue of AMTID, page 49.)

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Industrial Engineering

ENGINEERING DESIGN HANDBOOK. MAINTAINABILITY GUIDE FOR DESIGN

Army Material Command. October 1972. 448 pages.

AD–754 202

The importance of maintainability in equipment design cannot be overemphasized. It is the objective of this handbook to influence design so that equipment can be (1) serviced efficiently and effectively if servicing is required, and repaired efficiently and effectively if it should fail, or (2) operable for the period of intended life without failing and without servicing, if possible. The book embraces the extent and nature of the maintenance problem and the principles and techniques that offer a solution to the problem. The various sections of the book are concerned with the extent of the maintenance problem in terms of the expenditure of money, men, and materiel; maintainability objectives, principles, and procedures; the nature of the maintenance problem in terms of the conditions under which equipment must be operated and maintained, from the logistical, human, and environmental points of view; design considerations which have application in many types of equipment; and considerations applicable to some specific types of equipment. This handbook is an updated version of AD-823 539, described in AMTID, July 1972, page 46.

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SIXTH ANNUAL CONFERENCE ON MANUAL CONTROL

National Aeronautics and Space Administration, Scientific and Technical Information Office. 1972. 354 pages.

NASA–SP–281

This document is comprised of the proceedings of a conference, held at the University of Southern California 2-4 June 1971, which was devoted to various aspects of the human operator in man-machine systems. In addition to the well-established areas of human operator modeling and display systems, the conference devoted considerable time to the extension of manual control theory to such diverse areas as automobile driving, air traffic control, and industrial management. The general subject matter covered includes: Modeling the tracking and decision aspects of human controllers; new applications of manual control theory; the physiology which underlies manual control; analysis of displays in man-machine systems; processing visual information by operators; applications of manual control theory to the driver/automobile system; the application of manual control theory to the prediction and evaluation of performance; and the interaction of sensory channels.

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AN ANALYSIS OF THE EFFECTS OF SELECTED SCHEDULING RULES IN A PARALLEL PROCESSOR SHOP

Union Carbide Corporation. D. H. Gentry. August 1972. 160 pages.

Y–1848

A repair shop foreman is usually expected to work his job back- og in such a way as to meet schedule dates and maximize the abor efficiency of his crew. Given such inputs as tight scheduled lates for jobs, high shop backlog, material procurement problems, pending sufficient time actually supervising his crew, solving tech- ical repair problems, etc., such an exception is difficult to achieve. election of scheduling rules for the shop should help the shop oreman to meet these expectations to a greater degree by giving he foreman more time for actual supervision of his personnel. This document investigates the application of scheduling rules which have been used in production job shops to the maintenance epair shop. Consideration is given to the effectiveness of various cheduling rules which arrange the shop jobs in a particular order o be worked subject to the effect of random departures from the ob order as determined by these rules, the effect of estimator bias n terms of the hours necessary to complete the job, and the effect f varying shop loads.

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Highway Engineering

TRIP FOOTING ANALYSIS

ederal Highway Administration. Ranbir S. Sandhu. April 1972. 0 pages.

B–213 149

he bearing capacity of footings on saturated soils is greatly in- uenced by the occurrence and dissipation of pore pressures in ie foundation soil. This report documents theoretical as well as omputational aspects of the application of the finite element ethod of numerical solution to settlement analysis of strip foot- gs in such soils. The development of field equations governing onsolidation is outlined, and the matrix formulation of the prob- m is given. A computer program, applicable to strip footings oth rigid and flexible) and settlement under embankments, is cluded.

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Highway Engineering
(continued)

BRIDGE EXPANSION JOINT SEALS

California Division of Highways, Bridge Division. Bruce J. Gunderson. July 1972. 128 pages.

PB–213 962

Since metal structures are subject to varying magnitudes of expansion and contraction as the result of changes in local temperature, bridges are designed with open spaces between deck members to allow for such movement. If the spaces cannot be left open because of eventual damage through the intrusion of debris, chemicals, and water, a system of sealing must be employed. Joint seal research has progressed from asphalt latexes through polysulfides and polyurethanes to preformed elastromers. The document reports on a program for testing various sealing products, placing the more promising ones in the field, and checking service performance. A method is described for recording joint movement characteristics and joint seal capbilities, and the relations between bridge deck joints and air temperature are discussed. Some recommendations are made.

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Housing and Urban Technology

RISK ANALYSIS AND DECISION MODELS IN THE PLANNING OF HOUSING PROJECTS

Massachusetts Institute of Technology, Department of Civil Engineering. Jorge A. Machado. June 1972. 123 pages.

PB–212 613

There seems to be an almost universal agreement among participants in the planning of housing projects that cost is a problem that must be meet if future demands for housing are to be met. Where agreement does not seem to come so readily is in defining what the nature of the problem is and much less what the solution might be. Another point of common agreement is that the housing industry is fragmented. This report addresses itself to the problem of fragmentation and indirectly to the problem of cost. It is argued that by using an adequate representation and evaluation framework for alternative solutions that arise in the planning of housing projects, it is possible to improve the communication between participants and to put the problem of cost in its proper perspective. This framework is composed of two elements: The formulation of an investment policy and the construction of a hierarchical model of the project. A description of the variables involved and the equations by which they are computed are given. An example problem is implemented and conclusions are given as to the usefulness of the proposed concepts.

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SCIENCE AND TECHNOLOGY FOR THE CITIES

National League of Cities; and U.S. Conference of Mayors. John Feild. July 1972. 120 pages.

PB–212 762

The scientific and technological advancement of municipal areas is currently being related to recognition by city officials that specific and general problems can be handled with the utilization of advanced techniques, that human resources and expertise are available to attack these problems if made known and put to work, and that systematic development of modern standards is possible by coordinating all these possibilities. The report discusses several categories to this end, including the employment of displaced scientists and engineers by local government, the organization of regional programs, the relations of scientific and technical services within a local government and the need for such services, federal-local coordination, and the improvement of relationships between local governments, consultants, and advisers along with the improving of procurement operations.

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THE BRAVO STORY

Self-Help Enterprises, Inc. Robert Marshall. March 1972. 87 pages.

PB–214 175

This document describes a program undertaken among migrant and seasonal farmworkers in California to improve their housing conditions and develop skills necessary for a productive and self-sufficient life. The project involved the establishment of a manufacturing facility, Bravo Industries, for the production of modular components for low-cost housing. The facility is staffed, both at the supervisory and laborer levels, with individuals drawn from the migrant farmworker community who are trained in the necessary skills. The modules are then sold at very favorable rates to other farmworkers, who erect their own houses with the assistance of Bravo Industries. Consideration is given, in this document, to the self-help concept; the organization of Bravo Industries; details of the modular housing production systems, and techniques; manpower development; self-help systems for the erection of the houses; and financial considerations.

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Hydraulics and Fluidics

NASA CONTRIBUTIONS TO FLUIDIC SYSTEMS. A SURVEY

Computer Sciences Corporation. Terry M. Weathers. 1972. 110 pages.

N73–11260

A “fluidic system” is a system in which some sensing, signal proces-
sing (logic), control, and/or amplification functions are performed
hrough the use of fluid dynamic phenomena, without relying upon
noving parts or electrical components. Today fluidic systems are
n use throughout the world. Applications include monitoring and
ontrolling industrial processes and operations, and the environ-
nental control of large buildings. Interesting medical applications
ave been studied and commercial medical equipment employing

Hydraulic and Fluidics
(continued)

a fluidic system has appeared on the market. This survey report is a state-of-the-art review of fluidic technology. It is orientated toward systems applications rather than theory or design. Emphasis is on contributions resulting from work done by or for the U.S. National Aeronautics and Space Administration. It is intended that the examples described and the criteria presented for evaluating the suitability of fluidics to new applications will be of value to potential users of fluidic systems. Means are suggested whereby a company may use a fluidic system effectively either to manufacture a product or as part of the end product. The survey also includes a glossary of fluidics terminology and symbology, and a selected bibliography that can aid in an understanding of fluidic systems.

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CONTROL OF SURGING IN LOW-PRESSURE PIPELINES

Bureau of Reclamation. John J. Cassidy. September 1972. 44 pages.

PB–212 816

In a low pressure pipeline system, one in which the hydraulic gradient is approximately parallel to the ground and the discharge is controlled at the upstream end, special problems are produced when the flow is operating below the design discharge rate. An unsteadiness which develops may be amplified to the extent that surges arise which can overtop the pipe checks or pipe stands unless control measures are applied. The report describes a study centered around experiences with the existing Coachella Valley canal in California and the Canadian River aqueduct in west Texas. Also included is a summary of previous work, all results being given in a form which should be useful to low pressure pipeline designers. Equations of motion are presented and interpreted for actual conditions. Among the topics discussed are stability, periodic inflow changes, reach considerations, and test procedures.

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Machinery and
Equipment

TIME TRANSIENT APPROACH TO THE SOLUTION OF SHAFT DYNAMICS PROBLEMS

Columbia University, Department of Mechanical Engineering. David Breed, and Vittorio Castelli. June 1972. 339 pages.

AD–754 341

Almost every machine built today contains at least one part which rotates and might be called a shaft or rotor. For most of these machines the shaft or rotor is sufficiently massive and operates at a sufficiently low speed that for all practical purposes it may be considered to be a rigid body. However, other types of machine exist which possess shafts or rotors which, because of low mass and high operating speed, no longer follow strictly rigid body dynamics.

This report presents a method for rotor dynamic analysis which has sufficient generality to treat nonlinearities, time transients, steady states, dynamic response and critical speeds for unbalanced, nonuniform shafts on any type of bearing suspension. The technique consists of integrating the transient equations forward in time. The principal area of interest is in the field of turbo-machines, such as found in process equipment, propulsion systems, and axial flow compressors.

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AUTOMATED DEVICE FOR DISPENSING PRECISE AMOUNTS OF POWDER

Monsanto Research Corporation, Mound Laboratory. J. M. Osborne, H. R. McGraw, and C. F. Draut. 1972. 21 pages.

MLM–1917

A device for dispensing precise amounts of powder is described. Less than gram quantities may be dispensed at a rate of ⅓ gram/min with a precision corresponding to a weight range of about 0.001 gram for a series. Dispensing consists of moving particles in a flow that permits cut-off after delivery of the desired amount. Movement of powder is effected by the vibratory motion of a miniature pneumatic vibrator. The device is small and readily conformable to positioning with a weighing unit. Also, it may be safely used in explosive atmospheres. A list of suppliers of the components for this inexpensive device is included.

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THE APPLICATION OF ELASTOHYDRODYNAMIC LUBRICATION IN GEAR TOOTH CONTACTS

Lewis Research Center (NASA) Dennis P. Townsend. October 1972. 49 pages.

N72–33479

Gears may fail from many causes such as tooth fracture, scoring, pitting, and wear. For a gear system to operate for a long life without wear or scoring and other surface-type failures, it must be lubricated in a way that will prevent the occurrence of more than a slight amount of metal to metal contact. This type of lubrication, which prevents or minimizes surface asperity interaction is referred to as elastohydrodynamic lubrication. This lubrication mode is differentiated from boundary lubrication which comprises essentially metal to metal contact with a chemical or oxide film preventing gross wear or welding of the asperities. An outline and definition is provided in this document of those parameters which affect the lubrication of gears, including surface finish, tooth design, lubricant type, and elastohydrodynamic principles and their application.

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Machinery and Equipment (continued)

BIN HOPPER ENGINEERING AND BULK MATERIALS FLOW: A STATE-OF-THE-ART REPORT ON EMPIRICAL AND THEORETICAL ANALYSES

Bureau of Mines, Pittsburgh Mining and Safety Research Center. W. G. Pariseau and R. S. Fowkes. 1972. 39 pages.

PB–212 505

The materials handling efforts in mining, agricultural, chemical, and process industries about the world are enormous, the cost of which may account for more than half the full cost of a product. Where repeated handling of large tonnages of low grade materials is required, expense can be saved by utilizing gravity, the cheapest of energy sources. The report discusses the bin hopper as an effective device in this class, assessing methodology in a gravity flow bin hopper engineering, and reviewing flow regimes. Functional and structural design problems are reviewed, and useful mathematical formulations are presented. Some typical properties of selected bulk materials in the mining field are noted, along with three types of flow patterns. Indications are made for further developments.

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PRACTICAL DESIGN CONSIDERATIONS FOR THE APPLICATION OF GAS BEARINGS TO MACHINING PROCESSES

Union Carbide Corporation. P. J. Steger. 1972. 15 pages.

Y–DA–4541–REV–1

The application of externally pressurized gas bearings to the machining process can provide important advantages in performance and operational reliability. It is important in the design to consider the practical aspects of fabrication, assembly, and maintenance if these advantages are to be fully realized. This report discusses these aspects. It is shown that a successful design must incorporate easily fabricated geometries, stable structural systems, and a material compatibility which enhances bearing reliability. Operating experience indicates that gas bearings, using the design and fabrication techniques and procedures discussed, are both practical and economically feasible for production machine tools under moderate operating conditions.

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Manufacturing Methods

CHEMICAL MILLING. A DDC BIBLIOGRAPHY

Defense Documentation Center. November 1972. 160 pages.

AD–752 050

This bibliography is comprised of abstracts of reports of U.S. Government-funded research on chemical milling. The time period covered is approximately 1960 to mid-1972. Subject, title, corporate author, personal author, and report number indexes are included. The reports listed in this bibliography are available from NTIS.

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A STUDY OF MECHANICS OF CLOSED-DIE FORGING. PHASE II

Battelle Columbus Laboratories. James R. Douglas, and Taylan Altan. November 1972. 118 pages.

AD–752 588

The report represents the second, and final, phase of a manufacturing improvement program which was undertaken to develop technical information for improving the efficiency and productivity in the design and control of forging processes (for the first phase report, see AD-711 544 in AMTID, January 1972, page 45). This was accomplished by establishing and determining the influence of forging variables, such as material properties, friction conditions, and equipment characteristics, upon the forging process. The results are reported in seven chapters, each of which may be read independently of the others. Topics covered by the chapters are: Flow stresses of metals in forging; instrumentation and monitoring of forging presses; designs, applications, and comparisons of mechanical presses and screw presses for closed-die forging; determination and comparison of characteristics of hydraulic, mechanical, and screw presses for forging; isothermal uniform compression tests for determining flow stress of metals at forging temperatures; ring compression tests for determining flow stress and friction at forging temperatures; prediction and measurement of forging load under production conditions.

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THERMAL SHOCK DEBURRING

Bendix Corporation, Kansas City Division. J. H. Kuehnle. June 1972. 45 pages.

BDX–613–642–REV

Thermal shock deburring involves the exposure of a part to transient elevated gaseous temperatures created in a sealed, confined space. Flash, burrs, and sharp edges are reduced or eliminated by melting, chemical reaction with the gas, and physical and thermal shock. This report gives the results of an investigation of the operating parameters of the method using parts of various metals and plastics. The results indicate that the thermal shock deburring process may be considered for use for those applications where the process is compatible with the part material and geometry. In such cases, the instantaneous and repeatable nature of the process would reduce deburring time and improve quality.

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FUNDAMENTALS OF ION PLATING

Sandia Laboratories (AEC). D. M. Mattox. October 1972. 26 pages.

SC–DC–722284

Manufacturing Methods (continued)

Ion plating is a generic term applied to atomistic film deposition processes in which the substrate surface is subjected to a flux of high energy ions sufficient to cause appreciable sputtering before and during interface formation. This technique has been used most often to provide good adhesion between a film and a surface. It has also found use for the formation of corrosion-protective coatings and the fabrication of electrical contacts. This report reviews the fundamental concepts of ion plating and discusses the problems that are peculiar to these deposition processes. Several representative applications are described.

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Marine Engineering

FOUNDATIONS FOR SMALL SEAFLOOR INSTALLATIONS

Naval Civil Engineering Laboratory. H. G. Herrman. September 1972. 42 pages.

AD–750 259

Foundation design procedures are presented for small unmanned seafloor installations. The guidelines are for structures having maximum dimensions of less than 15 feet, which are to be placed in water depths greater than 30 feet for periods ranging from several hours to several years. The information is intended for those who must design and emplace such structures and whose background does not include a familiarity with seafloor foundation design principles. The topics covered include physical characteristics and typical configurations of seafloor foundations, design conditions, bearing capacity, lateral forces, overturning, tiedowns, foundation materials, and foundation emplacement considerations.

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SHORE PROTECTION, PLANNING AND DESIGN

Army Coastal Engineering Research Center. June 1966. 580 pages.

AD–750 451

This document is intended to provide, insofar as practicable, a coastal engineering manual of practice for shore protection. The term “shore protection” is considered to include primarily works designed to stabilize seacoasts and shores of large bodies of water where wave action is the principal cause of erosion. Much of the material also has application to works designed to protect navigation channels and harbors in coastal areas. An effort is made to include a detailed summary of applicable methods, techniques, and useful data pertinent to the solution of shore protection problems. The first section discusses the factors considered important in the analysis of such problems, beginning with the sources of energy and characteristics of material, proceeding with the interaction of these factors, and ending with the development of functional plans. The second section presents generally accepted practice in structural design techniques for shore structures. Graphs and tables to facilitate computations and analysis are provided throughout the manual.

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PLANNING FOR COASTAL PORTS ON A SYSTEMS BASIS: PRELIMINARY METHODOLOGICAL DESIGN

Pennsylvania State University, Pennsylvania Transportation and Traffic Safety Center. Joseph L. Carroll, and Michael S. Bronzini. May 1972. 245 pages.

AD–752 154

This report represents the first phase of an effort to develop a methodology for a systems approach to the evaluation of future deep draft navigation improvements. It is basically a state-of-the-art review which depicts the present situation regarding methodology and available mathematical models. An annotated bibliography of the relevant literature, a critique of existing models, and proposals for feasible approaches to future work are included. An evaluation system is proposed which integrates import and export commodity flows with modal split characteristics of the flows based upon inland travel and shipping modes. Impedance to the flows in the transport system would be identified and the relevant values assigned which would, in a feedback loop, affect the modal split of trade flows.

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HUMAN FACTORS GUIDE FOR THE DESIGN OF DIVER-OPERATED HAND AND POWER TOOLS

Whittenburg, Vaughan Associates, Inc., Oceanautics Division, Birger G. Andersen. July 1972. 149 pages.

AD–753 262

Over the years the human factors profession has generated a large quantity of research documentation, guidelines, and handbooks which provide human factors engineering data to assist designers and engineers in optimizing the development and utilization of man/machine systems and equipment. While these data encompass a broad range of systems and hardware, they are, for the most part, not applicable to the requirements of the underwater environment. For this reason, work was undertaken to expand the data base concerning man's ability to work underwater. This material is developed and compiled into a human factors guide relating to man's requirements and capabilities as an undersea worker. The format of the guide is one which emphasizes factual information expressed in graphic and/or tabular form. The subject matter coverage includes: Information which relates to the structure of he human body and its biomechanical capabilities; design features nd characteristics of various restraints and tethering systems that can be applied to a wide range of work situations; data relating to the problems of underwater visibility; human engineering control/display criteria and recommendations for the design and modification of tools for underwater applications; detailed human engineering evaluation of selected underwater tool items currently employed in underwater construction and salvage operations.

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DESIGN STRATEGY IN A COASTAL ENVIRONMENT

University of Delaware, College of Marine Studies. Rowland Richards, Jr., and David G. Elms. November 1972. 106 pages.

COM–73–10136

Engineering in a coastal environment is technically demanding. Waves, currents, high winds, variable soils, corrosion and tidal fluctuations combine to create a highly dynamic system in a geologic sense and one, at any instant, held in precarious balance susceptible to dramatic change with only slight external provocation. Engineers in charge of the planning and design of coastal structures are beginning to take a broader view of the problems involved and to expand the scope of the factors considered in design beyond the traditional range of technical questions. There is, however, no established precedent or methodology by which engineers can look at these broader problems. This report explores means of providing help for designers of coastal zone structures. One such approach is through the use of case studies, and a number of case studies involving viaduct design and construction are included to illustrate this concept. Also, the results of an analysis of the process of design as a system show areas where classifications, checklists, information sources, and other design aids are most needed.

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RESEARCH DIVER'S MANUAL

University of Michigan, Department of Meteorology and Oceanography. August 1972. 397 pages.

COM–73–10178

During the past two decades, diving with self contained underwater breathing apparatus, usually known as Scuba, has become an important method of scientific investigation. Independent of surface connections the diver works directly to observe, sample, and photograph in the underwater environment. The report discusses the principles, usefulness, and equipment of Scuba diving. Some of the materials are diving physics, physiological and medical aspects of diving, physical fitness requirements, diving procedures with and without breathing apparatus, self-contained diving, equipment maintenance, air requirements and control, accessory equipment, emergency and lifesaving operations, underwater environment and hazards, and surface supplied diving.

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PRECISION MEASUREMENT AND CALIBRATION. VOLUME 8. MECHANICS

National Bureau of Standards, Institute for Basic Standards. Roscoe L. Bloss, and Mary J. Orloski. January 1972. 580 pages.

COM–72–50352

This document is one of a series dealing with the precision measurement of specific physical quantities and the calibration of the related metrology equipment. Volume 8 is comprised of original papers, by members of the staff of the Mechanics Division of NBS, which have been reprinted by photoreproduction with occasional updating of graphs or numerical data when this has appeared desirable. Also included are abstracts of important papers in the field of mechanics by non-NBS authors. The general subject areas covered include acoustics, fluid mechanics, force, gravity, humidity, pressure, strain, vacuum, vibration, and viscosity. (Other books in this series which are currently available are: *Volume 5—Frequency and Time,* COM-72-50696, $6.00; *Volume 7—Radiometry and Photometry,* COM-72-50067, $7.00; and *Volume 9—Colorimetry,* COM-72-50697, $5.50.)

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A REPORT ON A SURVEY IN ECUADOR ON STANDARDIZATION AND MEASUREMENT SERVICES IN SUPPORT OF INDUSTRIALIZATION GOALS

National Bureau of Standards. Raul Estrada, Sanford B. Newman, and H. Steffen Peiser. May 1972. 49 pages.

COM–73–10326

The production of agricultural and manufactured commodities requires the support of standards, calibration, measurement, and testing services. These services have been important features of all developed countries and have accompanied the industrialization process of a number of recently developed countries. Such activities may be critical elements in developing economies for control of manufacturing processes, quality control of products, encouragement of experts, and the transfer of technology from abroad. The availability and level of these services in Ecuador was the concern of a survey made by an international team of experts. The results of the survey, and the conclusions and recommendations based thereupon, are the subject of this report. The subject matter covered includes: Background information on the nation of Ecuador and its priority goals; national institutes for standards, measurement, and quality control; regional standardization in Latin America; the role of the normalization of weights and measures in market equity; cost of a national capability in standardization and measurement services; standardization and measurement activities in industrial plants, educational institutes, and government organizations.

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CONTINUOUS EXPLOSIVE FRAGMENTATION TECHNIQUES

Bureau of Mines, Pittsburgh Mining and Safety Research Center. Richard Watson, and J. Edmund Hay. March 1972. 16 pages.

AD–751 022

This report describes the results of one year's work on a continuing program which is designed to improve the technology of the application of explosives to rapid excavation, particularly tunneling and mining of hard rock. Primary areas of concern are the development of jelled or slurry type explosives suitable for automatic injection into boreholes, and initiation systems alternative to conventional blasting caps for detonating these explosives. The work reported in this document chiefly involved: (1) Selection of suitable candidate explosives; and (2) investigation of potential initiation systems, including projectile impact, laser beams, and hypergolic liquid impingement.

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DESIGNING BLAST PATTERNS USING EMPIRICAL FORMULAS: A COMPARISON OF CALCULATED PATTERNS WITH PLANS USED IN QUARRYING LIMESTONE AND DOLOMITE, WITH GEOLOGIC CONSIDERATIONS

Bureau of Mines, Twin Cities Mining Research Center. Joseph M. Pugliese. 1972. 37 pages.

PB–212 507

Field studies of explosive blasting in rock quarrying have been conducted for a number of years, with an emphasis on minimizing detrimental geologic effects while maximizing beneficial geologic ones. The report considers an uncomplicated first-approximation method for designing blast patterns in line with geologic structure, and points to the validity of the technique by comparing drill and blast pattern dimensions used in the quarry with those determined by the method. Empirical formulas are presented for conditions of geologic structure that include bedding, jointing, folding, and caves, and for characteristics of explosives and field performance. A number of diagrams and tabulations accompany the text. Design changes are recommended for quarries where difficulties are occurring.

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THE STATISTICAL AND SPATIAL EVALUATION OF SULFUR AND ASH IN COAL SEAMS

Bureau of Mines, Division of Mine Systems Engineering. Manuel Gomez, Donald J. Donaven, and Kathleen Hazen. 1972. 50 pages.

PB–212 659

The efficiency of metallurgical and steam coal is affected by its content of mineral matter and sulfur, both considered as contaminants in industry and environment. Necessity to meet both utilization and atmospheric control standards has directed interest toward increasing accuracy in estimating sulfur and ash concentrations in a coal seam. The report outlines a statistical analysis approach which appears useful, which information collected from drill-hole samples is translated into the form of maps which can be interpreted before any coal is mined. The process involves standard deviation operations to determine the number of drill holes, probability computations for predicting sulfur and ash concentrations, and a computerized plot program for interpolating concentrations between grid points. Results are given in the form of contour plots.

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MEASUREMENT AND REDUCTION OF NOISE FROM DETONATING CORD USED IN QUARRY BLASTING

Bureau of Mines, Health and Safety Technical Support Center. Andris Viksne. 1972. 32 pages.

PB–212 665

In rock quarrying operations, where production blasting is initiated by a primer or trunkline, most companies prefer the use of exploding detonating cord for reasons of safety. Because of concern for workers' hearing, however, and because of community complaints, a means of reducing blasting noise levels is being sought, particularly in the case of the detonating cord. Results of a series of tests are reported, in which ten different types of cord were investigated for acoustic qualities. Two methods of reducing the noise were examined, one with the trunkline system covered with unconsolidated material, the other utilizing detonating cord with a minimal core load; of the two the latter method appeared the more feasible. A description is given of cord characteristics, test methodology, and data recording procedures and instrumentation. A statistical analysis is presented of the findings.

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SOLVENTS AND EXPLOSIVES TO RECOVER HEAVY OIL

Bureau of Mines, Bartlesville Energy Research Center. September 1972. 13 pages.

PB–213 049

In addition to the crude oil and natural gas produced from petroleum deposits, there are known to be billions of barrels of additional resources in heavy non-flowing oils and in tar sands which cannot be obtained by present technology. Many of the deposits are fairly shallow, so that alternatives to shale mining or fire flooding are desirable. Preliminary results of an explosive fracturing and solvent injection experiment are reported, in which three wells 35 to 50 feet apart were drilled to a depth of 350 feet, and an open hole interval from 300 to 350 feet in a sandstone formation was explosively fractured by means of TNT in each well. An aromatic solvent was injected into one well intermittently for about 2 months, and the crude oil production was tabulated. Boiling point of the solvent was limited to a 300 to 425 degree range, since a hot liquid was required which had to be distilled from the recovered oil. The various research equipment and methods are described, and indications are given for advances in the technique.

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FORECASTING THE PROPERTIES OF COAL SEAMS IN PLACE

Bureau of Mines, Division of Mine Systems Engineering. Manuel Gomez and Donald J. Donaven. 1972. 58 pages.

PB–213 933

The chemical and physical properties of coal, such as moisture, ash, sulfur, heating value, hardness, grindability, and lithologic structure have long been identified as significant variables that affect its end use. The need to establish the location as well as the quantity of these utilization variables in coal seams has brought about greater use of the methods of statistical analysis in evaluating coal deposits. The application of statistical methods, in turn, has pointed out the need for improvement in data gathering and sampling techniques, particularly in the collection of useful coal-seam properties and associated geologic variables that may be observed at the drill site and/or measured from drill-core samples. It is shown that available computerized techniques are useful and effective tools to forecast the between-sample-point values of coal-seam attributes on a regional basis, to predict the washability characteristics of a coal seam from relatively close drill-hole spacings, and to estimate the effect of joint trends brought about by the interaction of several variables on the property of interest. The results, which are cast in the form of contour maps, are easy to read and interpret and may be readily updated as more data become available during the process of exploration.

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DRILLABILITY STUDIES: PERCUSSIVE DRILLING IN THE FIELD

U.S. Bureau of Mines, Twin Cities Mining Research Center. R. L. Schmidt. 1972. 33 pages.

PB–213 966

There has been need for a reliable means of predicting the percussive drilling properties of various kinds of rock, particularly the drilling rates. Such information can serve as a guide in selecting equipment, forecasting rates of advance, and estimating operating costs. A report is made on an investigation in which two percussive drills mounted on a truck were used to drill a total of 25 rock types, and the results were used to develop a prediction equation. This equation was checked by a set of unrelated laboratory percussive drilling data, and a comparison is made between the predicted and the actual rates.

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SUMMARY OF MINING AND PETROLEUM LAWS OF THE WORLD. 2. EAST ASIA AND THE PACIFIC

Bureau of Mines. Northcutt Ely. July 1973. 110 pages.

PB–218 692

This document is comprised of condensed versions of the mining and petroleum laws of 25 jurisdictions of East Asia and the Pacific. Within these jurisdictions, primary attention is given to requirements that must be met for acquisition of rights to permit development of the mineral resources. Coverage includes: Identification of controlling laws or statutes governing minerals acquisition and reference to the administrative authority; analysis of laws governing mines, quarries, and their products; and analysis of laws applicable to natural gas, petroleum, and related minerals. The jurisdictions covered are: Australia (including separate sections for the individual States); British Solomon Islands; Brunei; Burma; Cambodia; Christmas Island; Fiji; Gilbert and Ellice Islands; Hong Kong; Indonesia; Japan; Republic of Korea; Laos; Malaysia (including separate sections for West Malaysia, Sabah, and Sarawak); Navru; New Caledonia; New Hebrides; New Zealand; Papua and New Guinea; Philippines; Singapore; Taiwan; Thailand; Republic of Vietnam; and Western Samoa. Part 1, *Western Hemisphere,* is available for $1.25 as PB-198 256 (see AMTD, April 1972, page 88; part 3, *Near East and South Asia,* is available for $0.75 as PB-211 100 (see AMTID, January 1973, page 68).

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Nondestructive Testing

A NUCLEONIC SENSOR FOR DETECTING METAL IN RECIRCULATING LUBRICATING OIL SYSTEMS

Nucleonic Data Systems, Inc. Michael C. Bertin. September 1972. 60 pages.

AD–752 580

The quantity of metallic debris in engine lubricating oil is an important indication of the condition of oil-wetted engine parts. This report describes the design, fabrication, and operation of a protoype in-line metallic debris sensor/monitor for recirculating lubricating oil systems which is based on x-ray fluorescence. In addition to detecting the level of contamination, x-ray fluorescence can identify the nature of the contamination by its characteristic x-rays. Also, dissolved meals as well as particles can be detected. The prototype unit demonstrated the ability to monitor the amount and rate of change in the amount of debris in a circulating lubricating oil system.

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STATE OF THE ART SURVEY ON HOLOGRAPHY AND MICROWAVES IN NONDESTRUCTIVE TESTING

Army Materials and Mechanics Research Center, Materials Manufacturing and Testing Technology Division. Robert C. Grubinskas. September 1972. 106 pages.

AD–755 116

This document traces the evolution and the state of the art of the relatively new nondestructive testing techniques arising from the vigorously active fields of holography and microwaves. Highlighted areas include the description of existing techniques and a discussion of their capabilities and limitations. Consideration is given to the application of these techniques to the evaluation of materials, strucures, and end items for quality assurance purposes. A bibliography of 845 entries is included.

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SUMMARY OF NONDESTRUCTIVE TESTING THEORY AND PRACTICE

Battelle Columbus Laboratories. R. P. Meister, M. D. Randall, D. K. Mitchell, L. P. Williams, and H. E. Pattee. October 1972. 175 pages.

N72–33482

A nondestructive test is any method of evaluating material and component characteristics without altering them of affecting component serviceability. Broadly, such tests are used to measure dimensions, detect flaws and defects, determine structural integrity, or determine the physical and mechanical properties or condition of an item. This survey of nondestructive testing methods is intended for program managers, supervisors, and limitations. Sufficient detail is provided to permit intelligent communication between these people and nondestructive testing specialists and to aid in formulating management and engineering decisions regarding applications and the need for additional research and development. Consideration is given to the use of penetrants, magnetic particles, radiography, ultrasonics, eddy currents, and some of the newer methods (thermal, acoustic emission, holography, microwaves, and eddy-sonic).

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ACOUSTIC EMISSION SENSORS AND INSTRUMENTATION

University of California, Lawrence Livermore Laboratory. Clement A. Tatro. January 1973. 25 pages.

UCRL–51320

Since the early 1960's, the use of acoustic emission techniques has become increasingly important in the nondestructive analysis of materials undergoing stress. This document deals with the parameters important to acoustic emission detection and applica-

Nondistructive Testing
(continued)

tion. It describes acoustic emission sources as to range of amplitudes, range of frequencies, and other aspects of the source signal pertinent to the design and selection of a satisfactory sensor. Also, the rationale for the classical method of instrumentation to process and display acoustic emission results is presented.

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Packaging

SHOCK AND VIBRATION TECHNICAL DESIGN GUIDE. BOOK 1 OF 2.
VOLUME I—METHODOLOGY AND DESIGN PHILOSOPHY.
VOLUME II—ANALYTICAL PROCEDURES

T. Bruce Henderson. Hughes Aircraft Company, Environmental Engineering Department. 1968. 185 pages.

AD–844 559

SHOCK AND VIBRATION TECHNICAL DESIGN GUIDE. BOOK 2 OF 2.
VOLUME III—RELATED TECHNOLOGIES

T. Bruce Henderson. Hughes Aircraft Company, Environmental Engineering Department. 1968. 626 pages.

AD–844 560

This design guide is directed toward the problem of dynamic structural integrity in packages intended to accommodate electronic equipment and other sensitive equipment. It is oriented toward military field requirements, but most of the material should be generally applicable. Volume I provides an overview of the approach which may be used in designing dynamic structural integrity into equipment packages. It also defines the dynamic terminology needed to address the design problem, provides a background of considerations and tradeoffs of importance to the engineer, and outlines a technique for effective use of the presented material. Volume II presents a straightforward quantitative approach to the evaluation of dynamic strength in an equipment package. Volume III is a compendium of the mechanical disciplines needed in solving structural problems associated with dynamic environments. The information presented includes dissertations on analytical tools and procedures, validation procedures, and hardware oriented disciplines. The entire design guide assumes a reasonable level of knowledge in structural mechanics on the part of the reader, but that he is not an expert in dynamics.

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DESIGN OF CONSUMER CONTAINERS FOR RE-USE OR DISPOSAL

Battelle Memorial Institute; and U.S. Environmental Agency. George F. Sachsel. 1972. 341 pages.

PB–214 012

Packaging
(continued)

This document contains 17 papers which were presented at a conference, held in May 1971, which was organized for the purpose of bringing together current knowledge and thinking in the disposal and reclamation of containers used to package consumer goods. The topics covered include: Packaging and solid waste management; recycling status and opportunities; packaging and environmental protection; packaging for food systems of the future; incentives for the recycling and reuse of plastics; thermoplastics in waste recycling; returnable plastic milk bottles; reclamation of plastic-paper composites; design trends in glass containers; reusing scrap glass; composite bottle design and disposal; separation of glass from municipal refuse; ferrous scrap recycling and steel technology; metallurgical aspects of reclaiming container scrap; recovery and utilization of aluminum from solid waste.

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TRANSPORTATION SHOCK AND VIBRATION DESCRIPTIONS FOR PACKAGE DESIGNERS

Sandia Laboratories (AEC). J. T. Foley. July 1972. 51 pages.

SC–M–720076

This report provides a basic review of methods of describing the source, character, and intensity of the dynamic (shock and vibration) environment of packaged cargo. Emphasis is on the environment encountered in aircraft, trucks, and ships. It is shown that present day efforts in environment description improvement are centered about predicting vehicle bed motions in a statistical manner. This allows a package designer to take a risk-oriented approach to determining design criteria. Appended to the report is a paper which describes models which predict the dynamic environment experienced by cargo during transportation. Consideration is given to information sources, methods of building the models, the method of representation, and advantages and limitations of the models.

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Power Sources

INTRODUCTION TO POWER PLANT DESIGN

Black and Veatch, Consulting Engineers. J. L. Evans, G. J. Hirt, M. L. Lippert, and G. E. Tyler. September 1972. 165 pages.

AD–751 173

This report documents and describes the process by which elements are selected for power system design to meet specified requirements. The design procedures presented include methods of obtaining the desired reliability of power systems and the desired power quality of power systems, and a method for estimating life cycle costs of power systems for comparison of power system alternatives. Design procedures include the application of steam turbine driven generators, diesel and gas engine driven generators, gas turbine driven generators, and hydraulic turbine driven generators for power systems of 1.5, 4.0, 25, 60, and 75 megawatt capacities.

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SEVENTH STATUS REPORT ON FUEL CELLS

Army Mobility Equipment Research and Development Center. Electrochemical Division. James R. Huff (Editor). October 1972. 190 pages.

AD–755 106

This report provides a review of the state of the art of fuel cell power sources, covering developments in this field that have occurred since 1967. In this period, basic research investigations have been concerned with the elucidation of reaction mechanisms at both the fuel and oxygen ,or air) electrodes; and catalysts for both electrodes have been prepared and tested. Exploratory development efforts have encompassed electrode fabrication and evaluation, materials, fuel treatment and conditioning, and a wide variety of conventional and unconventional fuel cell types. Advanced and engineering development work has been undertaken with a number of general and special types. Progress has been made on the problem of power conditioning, which is a vital part of any fuel cell system. A number of new experimental techniques and instruments have become available for use in the investigation of fuel cell reactions and mechanisms. All of these developments, both in the U.S. and elsewhere, are summarized and references to the original literature sources are provided.

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URBAN UTILIZATION OF EXTRACTED HEAT AND WASTE HEAT FROM CENTRAL STATION POWER PLANTS

Oak Ridge National Laboratory (AEC). Sam E. Beall, Jr.. and Arthur J. Miller. 1972. 21 pages.

CONF–720925–2

The efficiencies of the processes used to generate electricity vary from about 25% (simple cycle gas turbines) to 40% (modern fossil-fuel-fired steam stations). The wastage in energy implicit on these figures is doubly damaging because the combustion products and heat from electric generating stations are a significant source of environmental pollution. This report presents an analysis of the feasibility of using some of this normally wasted thermal energy for applications such as industrial processes, building space heating, air conditioning sewage treatment, agriculture, and aquaculture. It is shown that the use of extracted and waste heat from central station power plants reduces the consumption of fuels and thereby lessens the environmental impact of providing energy as compared to conventional systems. With large new cities or renewed old cities having areas of high population density, or with large concentrations of steam-consuming industries close to the plant, the dual-purpose plant system would be economically attractive.

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PHOTOVOLTAIC SOLAR ARRAY TECHNOLOGY REQUIRED FOR THREE-WIDE SCALE GENERATING SYSTEMS FOR TERRESTRIAL APPLICATIONS: ROOFTOP, SOLAR FARM, AND SATELLITE

California Institute of Technology, Jet Propulsion Laboratory. Paul A. Berman. October 1972. 27 pages.

N72–33061

A previous report (N72-26034; see AMTID, April 1973, page 84) considered areas for investigation that could significantly reduce the cost of photovoltaic solar arrays to be used for wide-scale terrestrial solar-to-electrical power generation. In this report, the same considerations are used with a broader philosophical scope to suggest an approach for solar array development applicable to three major systems for using solar voltaics to generate electrical power for terrestrial purposes. These systems are The Rooftop Array, which uses the roofs of buildings, both residential and commercial, as an area upon which solar cell arrays are mounted; The Solar Farm, employing large flat land areas to accommodate large-area photovoltaic solar generators; and The Satellite Station, in which large solar arrays are placed in synchronous orbit and transmit the energy converted to Earth. The technology advancement requirements necessary for each option are discussed, including cost reduction of solar cells and arrays, weight reduction, resistance to environmental factors, reliability, and fabrication capability, including availability of raw materials.

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PRELIMINARY ASSESSMENT OF A POTASSIUM-STEAM-GAS VAPOR CYCLE FOR BETTER FUEL ECONOMY AND REDUCED THERMAL POLLUTION

Oak Ridge National Laboratory. A. P. Fraas, August 1971. 52 pages.

ORNL–NSF–EP–6

Fuel supply limitations, environmental quality demands, and increasing electric generating costs strongly favor the development of a higher temperature, and more efficient, thermodynamic cycle for electric power plants. One possibility involves the use of a potassium vapor topping cycle with a turbine inlet temperature of about 1500° F. A decision study, described in this report, has determined the size, cost, and development problems of the new types of equipment required for such a system. The results indicate that a potassium vapor cycle superimposed on a conventional 1950° F steam cycle would give an overall thermal efficiency of about 54% as compared to only 40% from a conventional steam cycle. Thus the proposed system would have a fuel consumption only 75% and a heat rejection rate only 50% that of a conventional plant. The assessment indicates that capital cost may be less than that of a conventional plant. The main reason for this is use of pressurized combustion, which leads to a much smaller combustor, and thin tube walls to contain potassium at about the same pressure.

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UNDERGROUND AIR STORAGE AND ELECTRICAL ENERGY PRODUCTION

Oak Ridge National Laboratory. R. B. Korsmeyer. February 1972. 20 pages.

ORNL–NSF–EP–11

The problem of meeting peak power demands by large power plants is an acute one because it is not economical to change plant loads either rapidly or frequently. The peak-to-average power demand varies most severely on a daily basis in industrial and urban areas, although weekly and seasonal variations are often important too. Increasingly, large utilities have been turning to energy storage as a means of leveling out the demand into a nearly steady base load. One such method involves the compression of air in large underground caverns. Such air storage facilities can be located almost anywhere that firm rock can be found at depth. This review examines the potential advantages of pumped air storage and develops recommendations for research required to clarify the options.

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A UNIVERSAL SOLAR KITCHEN

Johns Hopkins University, Applied Physics Laboratory. C. J. Swet. July 1972. 27 pages.

PB–213 023

In the populous developing countries of today, large numbers of families must depend on the burning of foraged wood, vegetable waste, and dung to provide heat for cooking, household chores, and comfort. A substitute source of energy for these people, especially those of limited means, would significantly reduce air pollution and conserve woodland resources. One substitute is the relatively inexpensive solar radiation heater, already developed and in use. This device, however, is unsuitable for indoor or evening use, operates poorly on windy or cloudy days, and requires periodic manual positioning to follow the sun. The report presents an innovative design which appears promising, an outdoor-located line-focusing parabolic cylinder that concentrates incident solar energy onto a heat pipe for delivery to an indoor-located hotplate. Sun tracking is automatic, and operation in high winds is assured by aerodynamic configuration or total enclosure. Provision is made for a thermal storage unit for cooking in the evening or in intermittent sunlight. This solar kitchen has the advantages of moderate cost, adaptability to ethnic and regional practices, transportability, and producibility. It requires no special skills for installation or use. Two possible embodiments are described.

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SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOL. I

The Miter Corporation. April 1972. 231 pages.

PB–213 037

SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOL. II

The Miter Corporation. April 1972. 254 pages.

PB–213 038

SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOL. III

The Miter Corporation. April 1972. 201 pages.

PB–213 039

The documents are comprised of transcripts of the proceedings of the Symposium on Energy, Resources, and the Environment, which was held 12-14 April 1972. Volume I deals with international issues. Some of the topics covered include: Results of a computer simulation of world dynamics, and the implications for policy decisions; an economic basis for energy and resource use to solve international societal problems in the future; a review of world-wide energy demand and resources, and technology for meeting that demand; international aspects of the importation of natural gas. Volume II is concerned with ethics and environmental aspects of the demand and use of energy. The major topics considered include: National energy policy in terms of providing abundant, low cost, clean energy; the need for developing a "consensual energy ethic"; issues involved in developing an energy and environmental ethic; a comprehensive list of energy resource and environmental issues; mechanisms for achieving cleaner power. Finally, Volume III deals with options for the future and their resources, economic, and environmental effects. The topics include: Technological developments which provide a wide range of options for the future; the energy, resources, and environmental situation in Japan; the impact of man's energy use on world climate; proposal for a research and development program to meet the energy crisis.

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AN ELECTRIC CONVERSION FOR MECHANICAL-HYDRAULIC GOVERNORS OF WATER WHEEL TURBINES

Bureau of Reclamation, Engineering and Research Center. F. R. Schleif and C. L. Clemans. September 1972. 29 pages.

PB–213 619

Reliable speed governing is a necessity in a power system, and is even more demanding when interconnection with neighboring systems is incorporated. Since evidence of inadequate functioning is not immediately obvious in such a system, highly sensitive detectors of deviations are needed, along with fast and smooth response to load control. A conversion system for upgrading the performance of conventional mechanical governors for hydraulic turbines is described. It retains the proven long-term stability of the ball head speed reference but replaces the dashpot function with derivative terms from an independent frequence sensor. The result raises the governor system from temporary droop type to a higher order derivative-proportional-integral type. Installation is noted as simple, with control transferrable instantly. The advantages are discussed.

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ENERGY: USES, SOURCES, ISSUES

University of California, Lawrence Livermore Laboratory. A. L. Austin, B. Rubin, and G. C. Werth. May 1972. 129 pages.

UCRL–51221

The problems and issues involved in providing abundant supplies of low-cost energy are extremely complex, particularly when consideration is given to minimizing environmental impacts. An immense amount of information has been generated on the subject. This report condenses the available data and presents them in a format designed to emphasize the major points characteristic of the respective problems and issues. The topics dealt with include: Implications for industrialization, uses of energy costs, energy delivery costs, environmental constraints, capital available, industrialization lead time, petroleum, gas, oil shale and tar sand, fossil fuel reserves, uranium, water power, geothermal power, additional energy sources, projections, and issues.

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OUR SOLAR ENERGY OPTIONS: PHYSICAL AND BIOLOGICAL

University of California, Lawrence Livermore Laboratory. Arthur R. Tamplin. January 1973. 20 pages.

UCRL–51315

This report discusses various schemes that have been proposed for the utilization of solar energy. Both physical and biological systems are considered. The physical systems include solar cells, solar heat absorption and storage systems, spaceborne systems which convert solar energy to electrical energy and transmit it to earth, use of sea thermal gradients for the production of electrical energy, and use of mirrors to focus solar energy on a boiler system. The biological systems primarily involve the use of algae to convert solar energy into stored chemical energy. The primary purpose of the report is to provide a means of comparing the various schemes; a list of references is provided where more detailed technical discussions can be found.

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CONFERENCE PROCEEDNGS ON LNG IMPORTATION AND THERMAL SAFETY

National Academy of Science, Committee on Hazardous Materials. June 1972. 299 pages.

AD–754 326

A conference, the proceedings of which comprise this document, was held in June 1972 to review the state of knowledge of liquified natural gas (LNG) safety. The topics covered include: Explosive boiling of liquefied gases on water; LNG stratification and rollover; effects of stratification on boil-off rates in LNG tanks; radiation, heat flux, and overpressure in LNG tanks; fire hazard of LNG spilled on water; dispersion and downwind drift of LNG: radiation from large LNG fires; predicted behavior from venting of boiloff vapor from normal operation of LNG carriers; critique of technical knowledge for the safe handling and shipment of LNG; LNG vessel design and operating experience; operational aspects and controls for terminals; fire service appraisal of LNG.

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HAZARDOUS CARGOES

National Academy of Sciences, Committee on Hazardous Materials. H. H. Fawcett (Editor). November 1972. 259 pages.

AD–754 891

This report is comprised of the proceedings of the Seventh Annual Conference on Hazardous Cargoes, which was held in July 1970. Two main areas of concern are covered. The first is chemical reactivity, that is, the hazardous conditions created when two cargos accidentally mix under uncontrolled conditions. The second area of concern involves the establishment and operation of information systems in the fields of hazardous materials and transportation safety. Emphasis throughout is on waterborne transportation.

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CRITERIA FOR A RECOMMENDED STANDARD. OCCUPATIONAL EXPOSURE TO CARBON MONOXIDE

National Institute for Occupational Safety and Health. 1972. 125 pages.

PB–212 629

It has been determined that the potential for exposure of workers in industrial establishments to carbon monoxide is greater than that for any other chemical or physical agent. This report presents criteria and a recommended standard which are intended to meet the need for providing adequate protection for the safety and health of workers exposed to carbon monoxide. The criteria and standard are such that their implementation will protect workers against both acute and chronic carbon monoxide exposure; employ measurement techniques that are valid, reproducible, and readily available; and are attainable with existing technology. A general discussion of the biological effects of exposure to CO is provided, and a bibliography of 129 entries is included.

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REPORT ON LITERATURE REVIEW, SURVEYS, AND CONFERENCES: LEAD PAINT POISONING HAZARD DETECTION METHODS

National Bureau of Standards. Bernard Griefer. December 1971. 36 pages.

PB–213 351

It is generally accepted that the primary cause of lead poisoning of children is the ingestion of lead-bearing paint, putty, or other nonfood items in their environment. The chemical determination of lead in paint and building materials becomes the final step in any program involving the localization of this hazard. This report is comprised of a summary of selected chemical methods available for making such determinations. Special attention is given to methods suitable for the analysis of aged, crumbling, peeling, inhomogeneous dried paint chips or painted panels. A bibliography of 90 items is included.

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EVALUATION OF LEAD PAINT REMOVAL AND DETOXIFICATION METHODS

National Bureau of Standards. E. J. Clark, McC. Godette, M. A. McPherson, L. F. Skoda, and D. Waksman. December 1971. 42 pages.

PB–213 352

Many factors should be considered in the selection of methods for the elimination of lead paint hazards in dwelling units. In this report, currently used lead paint hazard elimination techniques are analyzed in terms of the attributes that can be associated with those methods. The attributes are associated with hazard inaccessibility, implementation considerations, and in use performance properties.

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PROCEDURES FOR LEAD PAINT REMOVAL AND DETOXIFICATION: GUIDELINES AND ATTRIBUTES

National Bureau of Standards. David Hattis, Marilyn McPherson, Leopold Skoda, and David Waksman. December 1971. 31 pages.

PB–213 535

In some cities, efforts are being made to reduce or eliminate the poisoning hazard to children which may result from the ingestion of lead-containing paint from the walls, woodwork, and fixtures of dwelling units. A series of guidelines has been developed in order to acquaint municipal planners and other decision makers with factors that should be considered when starting such a program.

Safety
(continued)

Methodologies are presented to assist responsible authorities to determine the source of the hazard, to determine the extent of the hazard, and to consider the factors that should be evaluated in the process of choosing methods for detoxification. In addition to the primary requirements of eliminating the lead poisoning hazard, the secondary attributes that are a function of the various solutions are presented. It is expected that these guidelines will be of particular value in areas which have had no experience in dealing with this problem.

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CRITERIA FOR A RECOMMENDED STANDARD—OCCUPATIONAL EXPOSURE TO INORGANIC LEAD

National Institute for Occupational Safety and Health. 1972. 103 pages.

PB–214 265

Lead and its compounds may be responsible for a fairly large number of toxic manifestations when inhaled or ingested into the body. This report presents criteria, and a recommended standard based thereon, which were prepared to meet the need for preventing occupational diseases arising from exposure to inorganic lead (lead oxides, metallic lead, and lead salts including organic salts, such as lead soaps, but excluding lead arsenate). The recommended standard is measurable by techniques that are valid, reproducible, and available to industry. Sufficient technology exists to permit compliance with the recommended standard. A discussion of the biologic effects of exposure to inorganic lead is included.

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Structural Engineering

DAMAGE TOLERANT DESIGN HANDBOOK

Battelle Columbus Laboratories, Metals and Ceramics Information Center. J. E. Campbell, W. E. Berry, and C. E. Federsen. December 1972. 431 pages.

AD–753 774

A compilation of fracture mechanics data is provided for high-strength aluminum alloys, alloy steels, stainless steels, and titanium alloys. The data represent state-of-the-art information on critical plane-stress intensity factors, plane-stress and transitional stress intensity factors, threshold stress intensity factors in corrosive media, sustained-load crack-growth rates in corrosive, and fatigue crack growth rates. The handbook is primarily intended to serve as the basic source of fracture mechanics data for those concerned with the design of damage-resistant structures. It is furnished with a looseleaf-type binder, and it is intended that periodic supplements will be issued.

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ANNOTATED BIBLIOGRAPHY ON CUMULATIVE FATIGUE DAMAGE AND STRUCTURAL RELIABILITY MODELS

System Development Corporation. V. K. Murphy, and G. Boyd Swartz. December 1972. 258 pages.

AD–754 062

Contributions to the area of modelling cumulative fatigue damage are scattered throughout the literature to the extent that it is difficult to know what the state of the art is in this field for the technical investigator who is concerned with predicting the cycles to failure under specified conditions. In view of this, a survey was made of the worldwide literature on the subject, and 97 publications were carefully selected with regard to their relevance. A critical summary is presented of each of the publications, some of them quite lengthly. Both the salient contributions and the limitations of the works are covered. The material should be of value to the engineer who wants to use the most up to date models, and the researcher who wants to improve on existing materials.

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JOINTS FASTENED BY HUCKBOLTS

University of Washington, Department of Civil Engineering. Desi D. Vasarhelyi. December 1971. 79 pages.

PB–212 839

Recently a swage-on collar type high-strength fastener for structures has been marketed with properties claimed to be equivalent to those of the high-strength bolt. The new fastener is called Huckbolt, its proprietary name. Advantages of the Huckbolt include its speed of installation, the fact that it does not require special skilled personnel as the fastener is automatically tensioned by the installation tool, and its ease of inspection by visual means. The results of a determination of the slip characteristics of double lap joints fastened with Huckbolts are given. In general, the Huckbolt-fastened joints exhibited slip resistance that was a good or better than joints fastened with standard high-strength bolts. The effect of the condition of the faying surface is discussed.

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CYCLIC LOADING OF FULL-SIZE STEEL CONNECTIONS

University of California, Earthquake Engineering Research Center. E. P. Popov, and R. M. Stephen. July 1970. 60 pages.

PB–213 545

Earthquake engineering of buildings involves the behavior of steel beams and frames under cyclic loading and the resistance of columns and welded joints to the simultaneous action of gravity and ateral loads. A series of eight tests of large full-size steel beam-to-column connections is reported, in which cyclic loading simulating earthquake effects on a building frame was applied to all-welded, welded flange, and bolted web A36 steel beams. The principal objective was to determine the behavior under severe cyclic loading well into the inelastic range, and to assess difference in performance among the several types. Hysteresis loops were obtained for stability study. The effectiveness of strain hardening is noted.

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Resource Surveys

A COMPARATIVE STUDY OF RESOURCE ANALYSIS METHODS

Harvard University, Department of Landscape Architecture. Carl Steinitz, Timothy Murray, David Sinton, and Douglas Way. August 1969. 398 pages.

AD–751 229

Given increasing public awareness of the need for resource use policies which will minimize the inevitable conflicts among the various demands for land, resource analysts, planners, and designers are challenged to go beyond the level of individuality and towards a level of understanding which approaches the theoretical. Effective land use planning will be the result of precise analytic and predictive methods, and to this end, a clearer understanding of current approaches to resource analysis must be had. It is for this purpose that a comparative analysis is presented of significant approaches to resource analysis used by selected individuals and groups. In order to make the descriptions of the methods comparable, a model for data inventory is applied. For each approach, a description is given of its methodological goals; the constraints under which the method was developed or under which it operates; the data variables which are investigated; the logic of the analytic approach; the applicability of the method to other areas, scales, and purposes; and its principal documentation. Finally, a comparison is made of the efficacy of the methods.

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MONITORING FOREST LAND FROM HIGH ALTITUDE AND SPACE

University of California (Berkeley), Forestry Remote Sensing Laboratory; and Department of Agriculture, Pacific Southwest Forest and Range Experiment Station. Harry W. Camp, Robert C. Heller, Robert C. Aldrich, et al. September 1971. 180 pages.

N72–28324

This document is comprised of a series of papers generated as a result of a continuing program involving the application of remote sensing techniques to problems of forest inventory and forest stress. The topics covered include: Microscale photo interpretation of forest and nonforest land classes; multiseasonal film densities for automated forest and nonforest land classification; classification of land use by automated procedures; monitoring the trend and spread of forest tree insect infestation; use of airborne spectrometers and multispectral scanners for previsual detection of trees under stress from insects and disease; detection of root disease impacts on forest stands by sequential orbital and suborbital multispectral photography; calibration of color aerial photography.

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FOURTH ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME I. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PROGRAMS

NASA Manned Spacecraft Center. January 1972. 509 pages.

N72–29302

This volume is one of a series which is comprised of presentations given at a review of the NASA Earth Resources Program which was held at the Manned Spacecraft Center, Houston, Texas, in January 1972. Volume I is concerned with work done at NASA facilities. The topics include: Reviews of program activities at the various facilities; radiometric images of infrared reststrahlen emissions from rock surfaces; Nimbus hydrological observations over the watersheds of the Niger and Indus Rivers; spectral reflectance measurements of plant-soil combinations; analysis of multispectral images simulating ERTS observations; microwave emission measurements of sea surface roughness, soil moisture, and sea ice structure; radiometric ocean color surveys through a scattering atmosphere; multispectral method of measuring sea surface temperatures from satellites; public health applications of remote sensing; a breadboard hybrid multispectral processing system; constructing and manipulating color imagery from digital data; salinity surveys using an airborne microwave radiometer; microwave brightness temperature of a windblown sea; detection of oil spills using a radar scatterometer.

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FOURTH ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME II. UNIVERSITY PROGRAMS

NASA Manned Spacecraft Center. January 1972. 606 pages.

N72–29327

This volume is comprised of presentations resulting from work done in the Earth Resources Program by various universities. The topics covered include: Summaries of the programs at the universities involved; information extraction techniques for multispectral scanner data; user oriented multispectral data processing; prediction of directional reflection of a corn field under stress; classification of spatially unresolved objects; experimental methods for geological remote sensing; experimental multispectral scanner system; multispectral imaging radar; surface configuration as an explanation for lithology-related cross-polarized radar image anomalies; parametric studies in radar agriculture; spectral reflectance measurements of a virus host model; application of remote sensing to water resources problems; differentiating elements of the soil-vegetation complex; land utilization and water resource inventories over extended test sites; advancements in machine analysis of multispectral data; advancements in large-scale data processing systems for remote sensing; microwave properties of geological materials; polarization effects with a combined radar-radiometer.

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FOURTH ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME III. U.S. GEOLOGICAL SURVEL PROGRAMS

NASA Manned Spacecraft Center. January 1972. 309 pages.

N72–29355

This volume is comprised of presentations of work accomplished by the U.S. Geological Survey under the Earth Resources Program. The topics covered include: Satellite relay telemetry in the surveillance of active volcanoes and major fault zones; geologic material discrimination from Nimbus satellite data; applications of near-infrared iron absorption bands to geologic mapping and mineral exploration; mapping of terrain by computer clustering techniques using multispectral scanner data and using color aerial film; remote sensing of air pollution from coal utilization; remote sensing of wet lands in irrigated areas; earth resources cartography program; automatic thematic mapping in the Eros program; geography and human-cultural resources in the Eros program; application of remote sensing to census taking; wetlands delineation by spectral signature analysis; discrimination of fluoride and phosphate contamination for analysis of environmental effects; relay of quantitative resources data by ERTS-A-, applications of spectroscopy to remote determination of water quality; spectral reflectance of selected aqueous solutions for water quality applications; quantitative relationship between reflectance and transpiration of phreatophytes.

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FOURTH ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME IV. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND U.S. NAVAL RESEARCH LABORATORY PROGRAMS

NASA Manned Spacecraft Center. January 1972. 451 pages.

N72–29378

This volume is comprised of presentations of Earth Resources Program work done by or for the National Oceanic and Atmospheric Administration and the U.S. Naval Research Laboratory. The topics covered include: Microwave characteristics of the ocean surface in the 1-10 GHz band; observations of oceanic whitecaps for moderate to high wind speeds; constraint of sun glint on visible data gathered by earth satellites; sea ice studies; regional studies using sea surface temperature fields derived from satellite infrared measurements; fisheries resource identification and assessment studies; comparison of remote sensors for soil moisture and other hydrologic studies; soil moisture mapping by ground and airborne microwave radiometry; laboratory investigations related to microwaves; application of thermal radiation data to fishery oceanography; detection of ocean chlorophyll from earth orbit; practical utility of the blue spectral region; factors affecting shallow-water bottom features; multispectral observations of marine environments; coastal and esturine applications of multispectral photography; temporal esturine flow dynamics.

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FOURTH ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME V. AGRICULTURE AND FORESTRY PROGRAMS

NASA Manned Spacecraft Center. January 1972. 281 pages.

N72–29407

This volume is comprised of presentations of Earth Resources Program studies in the areas of agriculture and forestry. The topics covered include: Development of analysis techniques for remote ensing of vegetation resources; resource analysis and land use planning with high altitude photography; infrared color film as a emote sensing tool; measurements from aircraft to characterize watersheds; microscale photointerpretation of forest and nonforest and classes; potential for obtaining poria disease signatures; pat-ern recognition of native plant communities. In addition, seven papers are included which consider corn blight detection and mon-toring.

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'HE APPLICATION OF REMOTE SENSING 'ECHNIQUES TO INTER AND INTRA URBAN NALYSIS

Jniversity of Iowa, Institute of Urban and Regional Research.
rank E. Horton. May 1972. 254 pages.

'B–214 449

emote sensing is a relatively new technique as applied to urban lanning. Aerial surveys are made of a metropolitan area, provid-ng photographs to be interpreted for such elements as population ensity and distribution, tree and water coverage, geographic or rrain characteristics, industrial and commercial sites, and space tilization. The report assesses the applicability of air and space-orne photography toward providing a data base for regional plan-ng, management, and research. A discussion is made of urban hange detection, economic, social, and demographic analysis for formation retrieval; residential and land use analysis, and the onstruction of mathematical models for statistical treatments and recasting. Considerable data are presented in tabular form.

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REMOTE SENSING: A DEVELOPMENTAL FRAMEWORK AND CASE STUDIES

Agency for International Development, Office of Science and Technology. Glenn E. Schweitzer, and John C. Fry. January 1973. 57 pages.

PB–214 861

This report is intended to assist developing country planners and technical specialists assess how their countries might participate more effectively in remote sensing activities sponsored by the United States and other developed countries. The first section, entitled "Prospects for Remote Sensing in International Development," emphasizing the economic environment in developing countries into which aircraft and satellite remote sensing programs must fit if the transfer of this technology is to be successful. The second section, "Practical Applications of Satellites in Earth Resource Surveys with Special Reference to African Countries," broadly describes the ERTS (Earth Resources Technology Satellite) system and selected applications. It notes the opportunity for developing countries to obtain ERTS-1 imagery for experimental investigations, and to formulate proposals for consideration for ERTS-B (scheduled for launch in late 1973). A third section "Space for World Development—Demography," describes specific applications of satellite multispectral imagery to population census, related agricultural statistics, and cartographic activities. The report concludes with three case studies. These include ERTS-1 experiments being carried out by the Governments of Mali and Lesotho, and a small aircraft experimental program being conducted by the Government of Indonesia.

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Transportation

STUDY OF LOW-DENSITY AIR TRANSPORTATION CONCEPTS

Aerospace Corporation. H. M. Webb. October 1972. 56 pages.

N72–33028

Many rural communities today have no rail, bus, or scheduled connections to the governmental, economic, or transportation centers in their region. This lack of public transportation hampers the economic development of sparsely settled rural, or "low-density," areas and contributes to social and ecological problems by encouraging the concentration of population and industry in urban areas. Results are provided in this report of a preliminary assessment of conditions in low-density areas under which air transportation service could be developed and of the potential operating schemes for satisfying the need. Emphasis is directed primarily at the situation in the U.S., but the methodologies and other considerations may be of value elsewhere.

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URBAN TRANSPORTATION RESEARCH AND DEVELOPMENT

National Academy of Engineering. May 1972. 77 pages.

PB–212 678

For millions of people without automobiles, many of the economic, social, and cultural advantages of the urban locale are out of reach because new urban developments often assume that people will drive. Consequently a serious unfilled need contributes to the problems of large segments of the urban population. The report, recognizing that much previous observation has been already documented, point to the need for program revision, focused increasingly on providing a better quality of urban life as well as better transportation. It discusses the considerations of costs, declining service, damaging side effects, jurisdictional factors, and possibilities for change. Some recommendations are made, and a typical urban design program is given. Source documents are quoted, and a bibliography is included. Some of the topics covered are government programs, automobile ownership, urban passenger and goods movements, institutional policies and practices, and innovative modes.

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ANALYTICAL METHODOLOGY AND OPTIMUM CONTROL IN URBAN TRAFFIC NETWORKS. VOLUME I

Cornell University, College of Engineering. Robert Bechhofer. February 1972. 69 pages.

PB–212 766

ANALYTICAL METHODOLOGY AND OPTIMUM CONTROL IN URBAN TRAFFIC NETWORKS. VOLUME II

Cornell University, College of Engineering. Robert Bechhofer, Stella C. Dafermos, N. U. Prabhu, *et al.* February 1972. 293 pages.

PB–212 767

ANALYTICAL METHODOLOGY AND OPTIMUM CONTROL IN URBAN TRAFFIC NETWORKS. VOLUME III

Cornell University, College of Engineering. Robert Bechhofer, Stella C. Dafermos, N. U. Prabhu, *et al.* February 1972. 282 pages.

PB–212 768

ANALYTICAL METHODOLOGY AND OPTIMUM CONTROL IN URBAN TRAFFIC NETWORKS. VOLUME IV

Cornell University, College of Engineering. Robert Bechhofer. Stella C. Dafermos, G. L. Nemhauser, *et al.* February 1972. 266 pages.

PB–212 769

Results are provided for an extensive series of analytical studies directed toward achieving optimal control of traffic in urban networks. Volume I summarizes the activities, scope, and research effort; and includes an abstract of each of twenty-six technical reports emerging from the effort. The remaining volumes contain the full text of each of the twenty-six reports. The subject matter of Volume II includes: An estimation problem involving queues with applications to traffic; a single server queue in discrete time; a computerized package for simulation of vehicular traffic flows in urban areas; an extended traffic assignment model with applications to two-way traffic; probabilistic models for queues at traffic lights; a traffic intersection with left turn lanes; a survey of some recent models for traffic on two-lane roads. Volume III covers: Low density traffic streams; network models for traffic assignment; optimal control of a signalized intersection; the virtual waiting time at a fixed cycle traffic light; individual versus social optimization in queuing systems; queuing of side street traffic at a priority type vehicle-actuated signal; traffic assignment problem for multiclass-user transportation networks; two models for queues at fixed-cycle traffic lights; cost control of queues. Volume IV covers: Framework for developing an urban traffic control model; traffic assignment computer programs; probabilistic methods for determining travel-time functions in a traffic network; decomposition algorithm for traffic assignment in networks; toll patterns for multiclass-user transportation networks; delay minimizing offsets in a congested network.

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A COMPARATIVE STUDY OF URBAN TRANSIT TECHNOLOGIES: THE SERVICE SPECIFICATION ENVELOPE APPROACH

Pennsylvania State University, Pennsylvania Transportation and Traffic Safety Center. John C. Rea and James H. Miller. August 1972. 83 pages.

PB–212 851

Urban transportation has become in recent years a focus of public and governmental attention. The surge stems from interest in the urban environment, the mobility needs of young, aged, and disadvantaged groups in the population, and a desire to provide a less resource consuming transit mode than the automobile. Accordingly there is a need for comparative analysis as the basis for selecting alternative urban transit technologies. The report discusses the service specification envelope as an evaluative tool for defining the area of applicability of a given technology and assessing the relative quality of the service offered. Economic viability and physical capacity are taken as the criteria, determined by the range of passenger flows. Envelopes are formulated for eight technologies, involving operating costs, fare structures, capacity limits, and travel speeds.

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PUBLICOS STUDY

University of Puerto Rico, Transportation Institute. June 1972. 138 pages.

PB–212 990

An unusual public transportation system operating effectively in Puerto Rico is described. It consists of privately owned sedan type vehicles operating at both the within-city and intercity levels, which pick up and deliver passengers practically anywhere along fixed routes. These jitney carriers, termed publicos or public cars, are issued special permits and regulated by the government, with their drivers required to hold an up-to-date chauffeur's license and special registration plates. The report examines the system with reference to the local economy, driver and rider satisfaction, and areas of greatest usefulness.

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MODELING TRANSPORTATION SYSTEMS: AN OVERVIEW

Transportation Systems Center. George Kovatch, and George Zames. June 1971. 53 pages.

PB–213 123

Modern transportation planning has reached a stage in which systems analysis is not only helpful but required. So many variables are involved that intuitive methods are futile; the advent of large digital computers, however, has made complex systems with many interdependent variables tractable. The report outlines the role of systems analysis and mathematical modeling in planning transportation systems. It reflects three sectors: demand for services by the public, supply or the ability of the system to deliver the services, and policy management effects on the equilibrium between supply and demand. Illustrative samples are given, with emphasis on structure, dynamics, and feedback effects.

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LIGHT RAIL TRANSIT SYSTEMS. A DEFINITION AND EVALUATION

Urban Mass Transportation Administration, Office of Research, Development and Demonstration. Vukan R. Vuchic. October 1972. 127 pages.

PB–213 447

The inherent advantages of rail technology for urban public trans- ortation are well known. However, it is usually believed that these haracteristics can be economically obtained only in high density orridors which justify the high investment cost of this mode. The act is that the "light rail" mode combines to a considerable extent he low investment of buses with the high level of service, capacity, nd potential for automation of the rapid transit mode. This report rovides a definition of the light rail mode, and presents the latest developments and experience with this mode. Its characteristics are analyzed in detail and actual data on its performance, demonstrated in practice, are given. The possibility of transition from light rail to rapid transit is also discussed.

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PORTS AND ECONOMIC DEVELOPMENT

Brookings Institution, Transport Research Program. Donald S. Shoup. September 1967. 273 pages.

PB–218 774

Efficient ocean ports are recognized as an important ingredient in a nation's economic development. In a developing nation the port system may play a crucial role, for while the total transport network may be advancing, the number of ports is generally small. The report discusses the economics of port operation and development, from which policy conclusions may be drawn, as based on certain assumptions. The first assumption is that developing countries are not wealthy enough to give anything away, so that any port user must pay for the use. Next, port policies are best which stimulate trade in both directions. The attempt is made to identify the problems involved in the economic analysis of ports and to suggest conclusions for government policy making. A few of the factors discussed are capacity, facilities, pricing, and technology change.

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FINANCING TRANSPORT IN DEVELOPING COUNTRIES

Brookings Institution, Transport Research Program. Alan R. Prest. December 1976. 231 pages.

PB–218 778

This document considers some of the issues of transport economics in underdeveloped countries. First the general background of the principles of charging consumers of public enterprise services is outlined. Some of the reasons why one may wish to temper the application of these general principles is also discussed. Then, actual transport pricing practices and the overall financial position of public sector transport in some selected countries are described. Contrasts are drawn between the actual position in these countries and the aforementioned general principles; and the plausibility of possible reasons for such differences is examined. Finally, after setting out the broad objectives and the administrative framework within which transport operations are likely to be conducted, a discussion is provided of direct charges on users, the possibilities of charging non-user beneficiaries from transport services, the various means of subsidy from government, the desirability of designating special funds for transport purposes, etc.

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QUALITATIVE VALUES IN ENVIRONMENTAL PLANNING: A STUDY OF RESOURCE USE IN URBANIZING WATERSHEDS

Harvard University, Department of Landscape Architecture. Peter Rogers, Carl Steinitz. October 1969. 187 pages.

AD–751 228

The problems of environmental quality such as pollution of air and water, noise, crowding, destruction of the natural flood control capacity of river basins, and aesthetics rarely enter into the models which have recently been developed for studying urbanization and for making planning decisions. The first part of this report provides a discussion of the use of systems analysis and operations research modeling techniques for making wise investment decisions in the public sector. Also, a critical review of these models from the point of view of environmental quality is included. A simulation model is then described which was constructed to enable planners to evaluate quickly the damaging impact of urbanization (and changing land uses) on the run-off characteristics of a river basin. Finally, consideration is given to the visual consequences of urbanization upon waterways which flow through the developing area.

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A METHODOLOGY FOR ASSESSING ECONOMIC RISK OF WATER SUPPLY SHORTAGES

Water Resources Engineers, Inc. G. K. Young, R. S. Taylor, and J. J. Hanks. May 1962. 163 pages.

AD–752 153

A methodology is presented which permits the determination of regional losses and risks associated with an urban-industrial area for actual and potential water shortage conditions. A test of the method is applied to an area which experienced a substantial water shortage in 1966. It is expected that the methodology will be useful as a planning tool, not only for estimating requirements on future water supplies, but also in allocating short supplies during emergency conditions.

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ICEBERGS AS A FRESH WATER SOURCE: AN APPRAISAL

Army Corps of Engineers, Cold Regions Research and Engineering Laboratory. W. F. Weeks, and W. J. Campbell. January 1973. 31 pages.

AD–755 815

An intriguing idea, although not a new one, is that icebergs can be towed to locations remote from the polar regions and used there as sources of fresh water. In fact, in the 1890's small icebergs were actually towed by ship and sailed to the coasts of Chile and Peru. This document provides a critical appraisal of the idea. Consideration is given to the following: Locating a supply of icebergs; calculating the power requirements necessary to transport the icebergs to a location where fresh water is needed; calculating the amount of ice that will be melted in transit; and estimating the overall economic feasibility of the venture. This preliminary appraisal indicates that the development of an operational iceberg transportation scheme offers the possibility of efficiently utilizing some arid coastal areas in the Southern Hemisphere for large-scale agriculture and perhaps for large agro-industrial complexes.

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A METHOD OF DEMINERALIZATION USING STRONGLY BASIC ION EXCHANGE RESINS

New Mexico State University, Department of Civil Engineering. William S. Midkiff. August 1972. 57 pages.

PB–212 272

Some areas lacking community water treatment facilities draw upon groundwater which is of marginal quality with respect to total dissolved mineral solids. A new method is described for demineralizing such waters for individual domestic use or, possibly, communal use in small communities. The method is based upon partial demineralization using a weak acid-weak base ion exchange system. The ion exchange column removes an increment of multivalent anions and cations and replaces them with an equivalent amount of water. Such a system has the potential of both simplicity and economy.

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URBAN RUNOFF

American Society of Civil Engineers. M. B. McPherson. August 1972. 53 pages.

PB–212 580

This report deals with some of the principal aspects of surface water runoff in urban areas. It was originally prepared for the information of the International Hydrological Decade/UNESCO Subgroup on the Effects of Urbanization on the Hydrological Environment. The topics covered include: Land-use changes in metropolitan areas; morphological changes in drainage; changes in flood characteristics; flood mitigation versus the amenities of drainage; some management possibilities; research status and needs; and some other developments and considerations.

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EVALUATION OF MEASUREMENT METHODS AND INSTRUMENTATION FOR ODOROUS COMPOUNDS IN STATIONARY SOURCES: VOLUME I—STATE OF THE ART

Esso Research and Engineering Company. H. J. Hall and R. H. Salvesen. July 1972. 98 pages.

PB–212 812

This state-of-the-art review presents and evaluates available information on the instrumentation available to measure the quantities of specific odorants in industrial plant emissions. The principal object is to examine the possibility of substituting a quantitative measurement of *odorants* for the subjective measurement of *odors*. The review presents background information for the basic definitions of the problem of odorant emission measurements, and the types of instrumentation available. Details are given of three industries considered as examples as odorant sources: kraft pulp mills, petroleum/petrochemical refineries, and animal rendering plants. Information is summarized on specific instruments which are commercially preferred, on available alternates, and on potential alternates where further development is required.

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SALINITY ABOVE A WATER TABLE AS AFFECTED BY RAINFALL AND IRRIGATION

South Dakota Water Resources Institute. Maurice L. Horton. August 1972. 38 pages.

PB–212 931

The heat, water, and nutrients which plants require for growth may be harmful if present in excess of need. Under irrigation, if water and nutrient supplies get out of balance, the soil environment may become unsuitable for plant development. Soils contain a variety of soluble chemical compounds, or salts, the critical sources of which are irrigation and fertilizers. Salt balance is ordinarily controlled by natural leaching, but if the area rainfall is insufficient and irrigation is being utilized, management for sustained production without environmental pollution requires a working knowledge of salts and water movement in the soil. The proximity of the water table to the surface is important, since this proximity controls the rate of which salts accumulate there. Thus periodic salinity measurements are necessary. A study is reported in which a water table was established at two depths, 60 cm. and 120 cm. in lysimeters made with undisturbed cores of biotia silt loam. The water table level in the lysimeters was automatically controlled, evaporation rates were measured. and changes in soil salinity were determined. A cover kept rainfall off the test setup. The results are discussed, and some recommendations are made.

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HYDRAULIC LABORATORY STUDIES OF A 4-FOOT-WIDE WEIR BOX TURNOUT STRUCTURE FOR IRRIGATION USE

Bureau of Reclamation, Engineering and Research Center. U. J. Palde. September 1972. 12 pages.

PB–213 138

Measurement of the water flow in an irrigation system can be satisfactorily accomplished by means of a weir with an associated vertical gage and baffles. The report describes the development and test of an improved rectangular weir box with a capacity of ten cubic feet per second, and discusses a hydraulics laboratory study to determine the head-discharge relationships. A baffle arrangement was constructed to distribute the inflow adequately from a circular pipe and provide satisfactory approach conditions to a 4-foot wide measuring weir. Discharge rating was obtained for flows between 2 and 12.5 cfs. A discharge equation was derived incorporating a variable effective head concept and consideration of flow approach disturbances.

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ECONOMIC ANALYSIS OF OPTIONAL WATER QUALITY MANAGEMENT

Purdue University, Water Resources Research Center. A. B. Whinston. August 1972. 288 pages.

PB–213 171

In recent years it has become feasible to use mathematical programing in selecting least cost strategies for water treatment in a river basin. At the core of this technique is development of a simulation model to determine the water quality effects of effluents and effluent patterns. Pollution problems begin to arise when within an urban development center waste disposal exceeds the capacity of the environment to assimilate the effluents. The report covers an attack on a two-fold problem: Collection and organization of data to determine strategy, and isolation of efficient, least cost treatment methods. The outline of the programming model is presented which takes into account the characteristics of a particular river and discharge characteristics. Some of the discussions concern the question of control by private sector or public administration, stochastic methods, environmental resource allocations, planning for pollution control, taxations, troublesome materials, and application of a non-linear programming algorithm.

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OPTIMIZATION OF WATER RESOURCES DEVELOPMENT: OPTIMIZATION OF CAPACITY SPECIFICATIONS FOR COMPONENTS OF REGIONAL, COMPLEX INTEGRATED, MULTIPURPOSE WATER RESOURCES SYSTEMS

University of California (Los Angeles), Engineering Systems Department. William W. G. Yeh and William J. Trott. June 1972. 40 pages.

PB–213 179

In designing a reservoir system, it is necessary first to decide on reservoir size in order to maximize benefit cost ratio with all constraints considered. Also, there must be good agreement between the simulated system at the design stage and performance following completion of the construction. Consequently a method is required to find the best possible set of design parameters if a regional, complex, multipurpose water resources system is to operate at optimal conditions. The report considers optimization as subject to many constraints, including hydrological, economic, social, political, legal, and physical ones. A method is developed for decomposing the original problem of high dimensionality into a series of subproblems of low dimensionality in such a way that the sequence finally converges back to the original problem. Incremental dynamic programming is used to find an optimal operating policy. The theories are applied to a real river project.

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ASSESSMENT OF TURBIDITY, COLOR, AND ODOR IN WATER

Anacapa Sciences, Incorporated. Douglas H. Harris. October 1972. 49 pages.

PB–213 180

Public acceptance of tap water is a fundamental consideration in the management and control of water quality. Although water quality may be defined in terms of complex physical, chemical, and bacteriological constituants, it is those characteristics that directly affect the human senses that have the greatest influence on acceptability. These characteristics are: turbidity, color, odor, and taste. This document is concerned with several aspects of the assessment of these "human factors" characteristics. First, a summary is given of the results of a survey of the methods used by 300 large water treatment facilities to measure turbidity, color, and odor. Then an assessment is made of the reliability of the most commonly used methods. Finally, an effort is made to relate systematically combinations of turbidity, color, and odor values to public acceptability of water.

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REUSE OF SURFACE RUNOFF FROM FURROW IRRIGATION

Oklahoma State University. A. D. Barefoot. 1972. 24 pages.

PB–213 255

The reuse of surface runoff water from furrow irrigation may be economically advantageous, necessary for regional conservation or protection, or required by law. Whatever the reason, a need exists for improvement of reuse system design. One major problem in design is how to estimate the amount and time distribution of the runoff. Results are given of an investigation in which six irrigated fields were instrumented to determine such amount and time distribution characteristics. Volume of runoff was calculated against volume of water applied, and the variation of designated sets was analyzed. The report discusses reuse systems which can be designed with either cycling or continuously operated pumps. Some favorable conclusions are presented regarding costs as disclosed by the tests.

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TECHNOLOGY TRANSFER IN WATER RESEARCH—THE INTERFACE BETWEEN PRODUCERS AND USES

Nebraska Water Resources Research Institute. Karen E. Stork (Editor). September 1972. 167 pages.

PB–213 740

The complexity of problems associated with water resources, together with social pressures for their solution, largely obviates the opportunity for research or interpretation of research on the part of the users of this resource. Universities and others must fill this void and provide reliable methodologies and data in a readily understandable form. A new look at traditional research design practices must be taken. This documents is comprised of the proceedings of a conference, held at Lincoln, Nebraska on 25-26 September 1972, which brought together research producers and users to consider this problem. It is intended to serve as a guideline for the development of user-oriented research programs which include the important factor of technology transfer. Some of the topics covered are: The importance of water technology transfer; importance of practical research input to water resources development; state of water technology transfer, deficiencies in current programs and positive suggestions for improvements; ways to overcome barriers between research users and producers; recommended procedures for developing effective technology transfer programs, ways to involve the user in the design and conduct of research projects.

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OPTIMUM CONJUNCTIVE USE OF A DUAL-PURPOSE DESALTING PLANT AND MULTI-PURPOSE SURFACE WATER RESERVOIRS

Echonotech Systems, Inc. Fereidoun Mobasheri, Vikram S. Budhraja, Ricardo C. Harboe, and Kerry Williams. November 1971. 148 pages.

PB–213 849

Water and hydroelectricity generation from surface reservoirs are subject to natural fluctuations due to seasonal and random changes in stream flows. The most adverse hydrologic conditions will usually determine the level of dependable water and energy productions. The ability of a desalting plant to supply fresh water during low streamflow periods might be used to augment the output of reservoirs. Such an arrangement would have a dual-purpose power and desalting plant with reserve capacity operating at some point economically close to a source of saline or brackish water. This would be operated as part of a system which would include a group of surface water reservoirs, with the dual-purpose plant supplementing the water and energy outputs of the reservoirs as needed. An analytical technique is described which permits the assessment of the economic benefits from a system of this sort operating in a given situation. The method can be used to determine the size of the desalting plant required, the load factor, the unit cost of water, and the constant and excess energy production, for a specified increment of water supply.

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PLANNING OF OPTIMAL URBAN WATER SUPPLY SYSTEMS

University of Michigan, Department of Environmental and Public Health. Rolf A. Deininger. July 1971. 16 pages.

PB–213 980

The design of urban water distribution systems has usually been studied from the viewpoint of balancing flows and pressures in the network, but a direct effort to find a network which can deliver water at the required rates and pressures has been lacking. What is especially needed is a formal mathematical approach which will directly select the best design. The report summarizes an effort to develop an economically optimal water distribution network, and describes a computer programming procedure utilizing a cathode ray tube display terminal. The basic problem was as follows: Given a source of water, a number of demand points, and desired pressure and flow requirements, a network is to be designed which will carry water to these points at minimum costs. Results are discussed, and some indications are given for further research.

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SELECTION OF TEST VARIABLE FOR MINIMAL TIME DETECTION OF BASIN RESPONSE TO NATURAL OR INDUCED CHANGES

Colorado State University, Department of Civil Engineering. H. J. Morel-Seytoux. December 1972. 19 pages.

PB–214 114

In an age of increasing interference of man with the environment, it has become essential to recognize rapidly the effects of deliberate management, the inadvertent effects produced, and the results of the caprices of nature. Detection tests are needed which utilize both physical and statistical information, combining linearly the pertinent types of variables. A new technique of detection is discussed in the context of precipitation, having applicability whenever a hydrologic change and a cause for change are suspected. The report presents a statistical model which involves effective coefficients of variation and correlation for a target area and a control. Data are taken from cloud seeding and runoff in a particular river basin, considering both economic constraints and methodology of measurements.

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ELECTROMAGNETIC PULSE SOUNDING FOR UNDERGROUND WATER

Ohio State University, Water Resources Center. R. Caldecott, D. A. Irons Jr., D. L. Moffatt, L. Peters Jr., R. J. Puskar, J. R. Toth, and J. D. Young. October 1972. 85 pages.

PB–214 122

Determination of the water content of subsurface soil is of importance in various engineering fields. It has long been known that the electrical properties of soil are directly related to the moisture contained, a relationship which has been utilized in radio propagation, but no instruments have been available to make use of these properties in soil surveying. The report introduces a technique by which repetitive pulses are radiated, which have been found equivalent to a wide frequency band. Two methodologies have been tested; one in which a long thin metallic cylinder buried in the ground and illuminated with pulses reradiates the signal and indicates the ground water content. The other consists of measuring the attenuation of the pulsed signals transmitted between a buried antenna and antennas on the ground. A discussion is given of the possibilities and limitations of each method, with indications for further development.

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DEVELOPMENT OF ECONOMIC WATER HARVEST SYSTEMS FOR INCREASING WATER SUPPLY. PHASE II

University of Arizona. C. B. Cluff, G. R. Dutt, P. R. Ogden, and J. K. Kuykendall. July 1972. 63 pages.

PB–214 128

Existing water supplies in semi-arid lands is limited. In many of these areas where groundwater is used for irrigation the water table is falling. The use of runoff farming techniques, whereby precipitation is concentrated on the land that is cropped, appears to be the only economic alternative to these lands reverting back to desert when the groundwater supplies are exhausted. Similarly these techniques appear to be the only way that large areas of new land can be utilized for agriculture. This document describes certain principles of water harvesting that can be used to concentrate precipitation in order to cultivate these lands. The design, construction, and evaluation of a number of different types of catchments and storage "tanks" is described. Particular attention is given to water harvesting systems suitable for use by livestock and, also, to multipurpose systems which may be used in conjunction with the growing of deep-rooted horticultural crops. In addition, the results of an evaluation of equipment for the installation of graveled plastic catchments and plastic-lined reservoirs are provided. (The Phase I report of this effort is available for $3.00 as PB-209 865. See AMTID, January, 1973, page 84.)

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SALINITY PROBLEMS IN ARID LANDS IRRIGATION: A LITERATURE REVIEW AND SELECTED BIBLIOGRAPHY

University of Arizona, Office of Arid Lands Studies. Hugh E. Casey. 1972. 311 pages.

PB–214 172

The subject of irrigation-related soil salinity is at once simple and complex. The subject is simple if one wishes to describe the nature of existing salinity problems. However, the factors involved in the creation of a salinity problem and the necessary steps in its prevention or improvement may become rather complex, both conceptionally and operationally. This report provides an evaluation of the literature on the subject in an effort to gage the broad accomplishments, trends, and gaps in the literature, identify areas most urgently in need of attention, and make recommendations in the light of these analyses. The bibliography contains 986 entries arranged according to the following subjects: Water balance problems; soil and water salts; salinity and drought effects on plants; reclamation and salinity prevention practices; salinity in river basins; socioeconomic aspects of salinity problems. Subject and author indexes are included.

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INCREASING WATER SUPPLIES BY SUPPRESSION OF RESERVOIR EVAPORATION

Oklahoma Water Resources Research Institute. Franklin R. Crow. January 1973. 37 pages.

PB–214 511

Water supplies in arid region reservoirs are always seriously affected by evaporation, and means to retard evaporation are constantly sought. A possible method lies in using floating covers of solid or flexible materials for small reservoirs. The report covers an investigation to determine the extent to which evaporation losses could be reduced by the installation of floating panels of one-inch thick styrofoam. Results are discussed for both unpainted and white-painted panels with regard to evaporation reduction, stored thermal energy, and efficiency as compared to other alternatives. Floating panel designs of two different types are described and evaluated.

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TECHNIQUES FOR ASSESSING HYDROLOGICAL POTENTIALS IN DEVELOPING COUNTRIES (STATE OF THE ART AND RESEARCH PRIORITIES)

Agency for International Development, Office of Science and Technology. January 1973. 73 pages.

PB–215 149

To use and control water effectively requires knowledge acquired through collection, analysis, and interpretation of hydrologic data. Also, the degree to which water resources can be effectively developed and utilized on a sustained basis is directly related to the level of understanding of the hydrologic environment. It appears that conventional techniques for the measurement and evaluation of basic hydrologic parameters are well understood in most of the developing countries. However, hydrologic assessments in these countries are sometimes retarded by unique climatic, vegetative, and geologic conditions which limit or render inappropriate the use of instruments and methodologies utilized in countries of the temperate regions. This report describes current capabilities and future needs for assessing hydrologic potentials in developing regions. Consideration is given to streamflow, erosion and sediment transport, water movement in unsaturated soils, ground water, precipitation, evaporation, and hydrologic applications of remote sensing. Both established techniques and methodologies and the most interesting emerging areas for attention are described. Where possible, generalized estimates of instrument and survy costs are included. Also, some of the more promising research approaches toward improved utilization and protection of water resources are discussed.

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DYE DILUTION METHOD OF DISCHARGE MEASUREMENT

Colorado State University, Engineering Research Center. W. S. Liang, and E. V. Richardson. January 1971. 38 pages.

PB–216 278

The recent development of fluorescence dyes and a fluorometer which can detect these dyes in very low concentrations, has made dye dilution methods practical for measuring and tracking water seeping from irrigation canals. A single-point, constant-rate dye injection technique is described which is inexpensive and easy to perform. The theory of the method is discussed, the equipment required is described and illustrated, the operating procedure is outlined in detail, and a measurement example is given.

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BIBLIOGRAPHY WITH ANNOTATIONS ON WATER DIVERSION CONVEYANCE AND APPLICATION FOR IRRIGATION AND DRAINAGE

Colorado State University, Engineering Research Center. Khalid Mahmood, A. G. Mercer, and E. V. Richardson. September 1969. 165 pages.

PB–216 280

This bibliography provides a list of publications of special interest to civil engineers on the subject of water management for agriculture. The topics covered by the bibliography include the following: River diversions, fluvial morphology and river training, diversion structures, canals and related structures, sedimentation and erosion, farm turnouts, flow measurement, land forming, methods of irrigation, and farm drainage. Annotations and brief summaries are included with many of the entries. A subject index is also included.

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ORGANIZATION OF WATER MANAGEMENT FOR AGRICULTURE PRODUCTION IN WEST PAKISTAN (A PROGRESS REPORT)

Colorado State University. P. O. Foss, J. A. Straayer, R. Dildine, A. Dwyer, and R. Schmidt. May 1970. 151 pages.

PB–216 284

This provides the results of an examination of the organizational structure for water management in Pakistan. The history, functions, organizational structure, and relationships with other agencies are presented for the following organizations: The Irrigation Department, Water and Power Development Authority, Department of Agriculture, Agricultural Development History, and Land and Water Development Board. Also, a discussion is provided of some aspect of the Pakistani civil service personnel systems. These aspects include an overview of the entire personnel system; some discussion of the historical roots of the system; a look at one portion of the system, namely the Civil Service of Pakistani; and some speculation as to the implications of the system for agricultural development.

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MAXIMUM WATER DELIVERY IN IRRIGATION

Colorado State University, Engineering Research Center. James Henry Duke, Jr. August 1971. 215 pages.

PB–216 285

One approach to meeting increasing demands on an existing surface irrigation system is the reclamation of water wasted through evaporation, transpiration, and percolation from the water delivery system. The improvement of irrigation water delivery management is an attractive method of effecting such reclamation measures, particularly if a system is composed of several reservoirs and interconnecting ditches that allow alternate routes for the delivery of water. This report deals with the application of modern mathematical optimization techniques to the management of irrigation water delivery. The first section provides a brief review of optimization techniques to acquaint those unfamiliar with the subject with both the terminology of operations research and the formulation of optimization problems. A determinisetic mathematical model is then developed which will simulate the events that occur in delivering water, from supply to the users, in an interconnecting, open channel irrigation system that contains reservoirs. The simulation model is constructed so that it can be linked to nonlinear programming and optimal results obtained. Examples and practical applications of the model are provided.

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STEADY AND UNSTEADY FLOW OF FRESH WATER IN SALINE AQUIFERS

Colorado State University. David B. McWhorter. June 1972. 54 pages.

PB–216 286

Exploitation of groundwater supplies for agriculture, municipal, and industrial uses is severely hampered in many regions of the world by the encroachment of unuseable saline water in response to fresh water withdrawals. Examples of saline water encroachment are most numerous in coastal aquifers, but it sometimes presents a problem in inland aquifers as well. Probably the most important example of the latter case exists in the Indus River Basin. This document presents a review of several existing methods for analyzing fresh-salt water interface problems, and it reports on some research dealing with the design of horizontal drains. Also, a procedure for estimating the behavior of the interface between fresh and salt water under unsteady flow conditions is presented, and some examples of possible applications of the derived unsteady state equation are given.

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THE PROBLEM OF UNDER-IRRIGATION IN WEST PAKISTAN: RESEARCH STUDIES AND NEEDS

Colorado State University. Garth N. Jones, and Raymond L. Anderson. June 1971. 58 pages.

PB–216 289

In the canal irrigated areas of Pakistan, it is common practice to distribute the limited water supply over as many acres as possible in order to assure a harvest, resulting in a form of under-irrigation. The practice is both profitable in the short run and is very much a part of the traditional agriculture pattern. There are many questions, however, concerning both the long-term effects of underirrigation and the possible effects of a more abundant and reliable water supply on Pakistan's agricultural development which remain to be answered. This report deals with the research needed to resolve these questions. Consideration is given to factors influencing plant water stress; effects of inadequate irrigations; water requirements for irrigated crops; and the relationship of crop water requirements to well-designed irrigation schedules.

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THE PROBLEM OF WATER SCHEDULING IN WEST PAKISTAN: RESEARCH STUDIES AND NEEDS

Colorado State University. Garth N. Jones, and William D. Romig. November 1971. 42 pages.

PB–216 290

Pakistan has experienced a century of modern irrigation and has developed considerable organizational infrastructure, professional and scientific talent, and management in this area. However, the problem of scheduling the delivery of irrigation water to farm fields in proper relation to crop and soil needs has remained relatively unexplored. This document deals with the research and other necessary requirements to develop and incorporate scientifically formulated water schedules within Pakistan's irrigation system. Consideration is given to models for irrigation scheduling, operationalizing an irrigation scheduling program, identifying basic organizational structure, the need for land and water law reform, and developing local water use organizations.

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A COMPARATIVE STUDY OF WELL IRRIGATION IN ALIGARH DISTRICT, INDIA

Cornell University, New York State College of Agriculture. T. V. Moorti. May 1971. 66 pages.

PB–216 794

The introduction of new technology to Indian agriculture has resulted in the increased use of fertilizer and water. Traditional methods of irrigation cannot supply enough water at low enough cost for high yielding varieties of staple crops. Tube wells can, however, meet this demand. This document provides the results of a detailed study of the economics of well irrigation which was undertaken in Aligarh District, Uttar Pradesh. Data were collected on a plot-by-plot basis from 141 farms representing 4 irrigation techniques. Different sources of irrigation were studied to provide a wide range of costs of water and to facilitate study of the effect of water cost on water use practices and returns. These data provide the basis for estimating the returns to water use at different levels of application and under varying farm operating conditions; analyzing the differences in cropping patterns, yields, and levels of technology accompanying different systems of well irrigation; and comparing costs and net returns to different systems of well irrigation; and comparing costs and net returns to different systems of well irrigation.

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REGIONAL WORKSHOP ON WATER RESOURCES, ENVIRONMENT, AND NATIONAL DEVELOPMENT. VOLUME I: SUMMARY OF PROCEEDINGS

Science Council of Singapore; and U.S. National Academy of Sciences. March 1972. 121 pages.

PB–217 117

This publication provides a summary of a workshop, held in Singapore 13-17 March 1972, which was organized to focus attention on current problems of water resources and the environment faced by countries of the Southeast Asian region, and to stimulate regional cooperation in seeking solutions. The regional nations involved in the workshop were Indonesia, Malaysia, Philippines, Singapore, Thailand, and Viet Nam. Included in the publication are the texts of the opening addresses and the plenary addresses; summaries of working group sessions on water resources, water pollution, and critical problems of the environment; overall recommendations; abstracts of the technical papers presented; and a bibliography of publications related to water resources, water pollution, and environmental problems in the Southeast Asian region.

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WATER MANAGEMENT RESEARCH IN ARID AND SUB-HUMID LANDS OF LESS DEVELOPED COUNTRIES (Third Anunual Progress Report)

Utah State University, Department of Agricultural and Irrigation Engineering. October 1971. 124 pages.

PB–217 741

This report provides detailed discussions of accomplishments in a program which has the overall objective of increasing food production in the arid and sub-humid areas in the less developed countries through the improvement of water management practices and the integration of these with other good management and cultural procedures. The research is aimed primarily at water management problems in the semi-arid lands of Latin America, but it should be applicable in principle to similar conditions in other regions. Some of the topics covered include: Irrigation interactions with crop varieties, plant populations, and fertilizers for optimum production of crops in wet-dry areas of Chile, El Salvador, Brazil, and Colombia; preparation of technical bulletins on water requirements on a country or regional basis; determination of the extent and nature of the drainage and salinity problems in Latin America; and economic evaluation of irrigation and irrigation research.

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FLOW IN SAND-BED CHANNELS

Colorado State University. Khalid Mahmood. February 1971. 294 pages.

PB–218 776

Water flow over sand-bed channels differs from that in other boundaries because of interactions which occur between the flow and the boundary, resulting in distortion and shifting of the boundary. Therefore the study of stream flow in lands having erodable sand boundaries will involve different factors from those which operate elsewhere. The report develops mathematical models for flow in rigid boundary and sand-bed channels, discusses the properties of natural sand mixtures, and considers the resistance and transport functions of sand-bed channels. Examples are given for two arid regions in different areas of the world (New Mexico and Pakistan). Graphic and tabular data are included for velocity profiles and transport parameters.

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SALT WATER CONING BENEATH FRESH WATER WELLS

Colorado State University. Brij Mohan Sahni. April 1972. 181 pages.

PB–218 781

In a region where irrigation is required, the ground water structure may consist of an aquifer containing fresh water, a saline water layer beneath the aquifer, and a separating or interface stratum between the two. Should the fresh water be pumped off without caution from the aquifer, salt water pressure from the saline layer will cause the interface stratum to bow upward in a behavior designated as coning, with probability of salt water intrusion into the aquifer. The freshwater-saltwater interface is not static but moves in response to motions of both fresh and saline water, so that well pumping and placement must be carefully controlled. The report is concerned with research designed to determine the performance of shallow or skimming wells from which fresh water will be pumped with minimum disturbance of the saline layer. Physical and mathematical models are developed to study the phenomena of coning and the prediction of maximum safe yield for given aquifer conditions and well geometry, and a discussion is given of the validity of assumptions and the analytic solutions based upon them.

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THE APPLICATION OF NUCLEAR ENERGY TO AGRICULTURE

Interamerican Institute of Agricultural Sciences of the OAS, Tropical Training and Research Center (Costa Rica). Carl C. Moh. June 1972. 251 pages.

COO–3217–5

This document provides a report of progress and accomplishments attained during three years of an ongoing series of studies involving the application of nuclear radiation to agriculture. The studies covered include: Induction of mutations in *Manihot;* a compact mutant in coffee; mutation breeding in the common bean; radiosensitivity of tropical plant species; sterilization of the Mediterranean fruit fly and its application to fly eradication; the biology and sterilization of the coffee leaf miner, *Leucoptera coffeella;* the biology and sterilization of the shootborer, *Hypispyla grandella;* pathological control of insect pests; radiation biology and mutagenesis of insect pathogens; soil acidity and exchange properties; phosphate chemistry in tropical soils; trace elements in tropical soils.

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GENETIC VULNERABILITY OF MAJOR CROPS

National Academy of Sciences. 1972. 315 pages.

PB–212 941

In 1970 an epidemic disease swept swiftly over the corn (maize) crop of the United States. The yield dropped an estimated 50 percent or more in some southern states and 15 percent nationwide. The corn crop fell victim to the epidemic because of a quirk in the technology that had redesigned the corn plans until they became genetically uniform. Whatever made one plant susceptible to the disease made them all susceptible. Such uniformity in a crop is an essential prerequisite to genetic vulnerability. This report emerged as a result of a major study of the gentic vulnerability problem. By way of providing a concrete example, the first part of the report examines the corn blight epidemic in detail. Technology is assessed; some historic epidemics and the phenomena of epidemics—the influence of the weather, the parasite, and the host—are examined; insect outbreaks are considered; and the economic implications are assessed. The next section deals with the genetic vulnerability of a number of major crops; corn, wheat, sorghum, pearl millet, rice, potato, sugar beet, sweet potato, soybeans and other edible legumes, vegetable crops, and cotton. Consideration is given to the importance of the crops, how they are bred to improve yield and reduce costs, and to what extent they may be genetically vulnerable to epidemics. The final section explores the challenges to science that are posed by genetic vulnerability.

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FOREST FERTILIZATION (A STATE-OF-THE-ART REVIEW AND DESCRIPTION OF ENVIRONMENTAL EFFECTS)

Environmental Protection Agency, Pacific Northwest Water Laboratory. William A. Groman. August 1972. 62 pages.

PB–213 073

Projected worldwide wood requirements indicate deficits within the next several decades, primarily due to the needs of an expanding population and the lack of additional productive forest lands to supplement existing sources. The application of chemical fertilizers to forest soils is one of the newest and most promising methods of attempting to meet these needs by increasing unit growth increment. This document provides a compilation of information pertaining to the concepts, scope, and methods of forest fertilization in various nations and regions of the world. Factors influencing development to present status, possible trends, and impacts on water quality are discussed.

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AGRICULTURAL BENEFITS AND ENVIRONMENTAL CHANGES RESULTING FROM THE USE OF DIGESTED SEWAGE SLUDGE ON FIELD CROPS

Metropolitan Sanitary District of Greater Chicago. T. D. Hinesley, O. C. Braids, and J. E. Molina. 1971. 73 pages.

PB–213 537

The disposal of liquid digested sewage sludge on land is a practice extensively used. It is less expensive than the alternate drying processes, and has the advantage of returning the materials to a natural cycle which could be agriculturally beneficial. This report describes the results obtained thus far in a continuing series of laboratory, greenhouse, and field studies of possible agricultural benefits and environmental changes which may be expected from land disposal. Consideration is given to the chemistry of liquid digested sludge; seed germination in the sludge; volatilization of ammonia; effect of digested sludge on nitrification and denitrification; digested sludge dewatering on soils; growth of maize on sludge-treated soils; lysimeter studies on yields, plant chemistry, soils, and leachates; fecal coliforms in liguid digested sludge and in soils irrigated with the sludge; and influence of soil moisture on fecal coliform survival.

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WATER USE EFFICIENCY OF VEGETABLE CROPS GROWN OVER ASPHALT MOISTURE BARRIERS

University of Delaware, Water Resources Center. William C. Liebhardt, Ernest N. Scarborough, and Anthony Digenakis. December 1972. 13 pages.

PB–214 120

The low productivity of sandy soils in humid areas can be attributed to low water holding capacity and high losses of soluble nutrients by leaching. One possible solution is the use of a subsurface asphalt moisture barrier to increase moisture retention and decrease leaching. This report gives the results of a study of the effect of such a barrier upon vegetation production on sandy soil. These results have indicated that the asphalt moisture barrier is an effective production practice with sandy soils where irrigation is not feasible.

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STUDY FOR AGRICULTURAL ENGINEERING DEVELOPMENT IN BRAZIL

Conselho Nacional de Pesquisas (Brasil); National Academy of Sciences (U.S.A.); and Food and Agriculture Organization of the United Nations. August 1972. 42 pages.

PB–214 534

There is a growing awareness in Brazil that the development of rural irrigation systems and electrification networks, design of farm structures, processing of agricultural materials, and greater farm mechanization all require professionally trained persons with engineering skills. To determine how the training and utilization of such personnel might best be accomplished, the Joint Study Group on Agriculture Engineering in Brazil was formed in early 1972. This report summarizes the major findings and recommendations of the Group. Consideration is given to the major technical problems involving agricultural engineering; needs for agricultural engineers; evaluation of human resources, physical resources, and educational and research activities in agricultural engineering; and institutional aspects of an integrated program in agricultural engineering. Specific recommendations are given for a long-term program in agricultural engineering education and research, and for gaining recognition for agricultural engineering as a profession under Brazilian law.

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NOTES ON THE CURRENT STATUS AND FUTURE DEVELOPMENT OF WEST PAKISTAN AGRICULTURE

Harvard University, Development Research Group. Carl H. Gotsch. May 1972. 46 pages.

PB–216 268

The economic development of West Pakistan, a relatively arid region, involves a rural system in which agriculture is successful and improvable, but tractor and deep well techniques are infeasible. The report considers several questions of importance: who controls the land, the potential for agricultural technology, policies of those institutions which serve farmers, and village organization. A review is made of previous progress, with some promising statistical data, followed by the presentation of an analytical model for future growth. One conclusion is that social change is inevitable, so that all planning must relate to it.

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TECHNOLOGY, PRICES AND INCOMES IN WEST PAKISTAN AGRICULTURE: SOME OBSERVATIONS ON THE GREEN REVOLUTION

Harvard University, Development Research Group. Carl H. Gotsch. October 1971. 51 pages.

PB–216 269

Green revolution is a term applied to the attainment of an extremely rapid increase in the productivity of agriculture in a number of poor Asian communities by the use of seeding and fertilizing techniques. The introduction of new and more successful genetic strains, and the application of controlled fertilizer dosages are important factors. Using a farm management model based on data from the Pakistan Punjab, the report analyzes the impact of the green revolution on agricultural development, including interactions between seed varieties, improved irrigation methods, and cropping patterns with regard to prices. An examination is made of the benefits from technical change, along with its impact on income. The political implications of this green revolution are considered, and policies are recommended to promote efficiency.

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RESEARCH ON THE SOILS OF THE LATIN AMERICAN TROPICS. ANNUAL REPORT, 1971

North Carolina State University. C. B. McCants, D. A. Sanchez, S. W. Buol, *et al.* 1971. 63 pages.

PB–216 271

The tropical regions possess enormous potential as a source of food and fiber, not only for its inhabitors but for those of other areas as well. The realization of this capability, however, will be influenced by progress in developing and implementing soil management systems which can recognize and modify those soil properties that restrict plant growth. This report concerns progress in a program undertaken to review, analyze, and interpret available information related to soil factors influencing crop production in the Latin American tropics. The first section summarizes the results of a review of the published literature on tropical American soils. The subject matter covered here includes: General soil conditions in tropical Central and South America; soil management in the humid forested region; nitrogen transformation and movement; nitrogen fertilization of corn, forages, beans, and other crops; nitrogen fertilization and management of rice; soil acidity and liming; potassium fertilization; sulfur fertilization; micronutrents status; soil physical properties; economics of fertilizer use. A technical classification of soil characteristics that bear a direct role on soil fertility management practices is proposed. Finally, summaries are provided of a number of research projects in progress.

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COMPILATION OF DATA TO PREPARE FEED COMPOSITION TABLES FOR THE LATIN AMERICAN TROPCS

University of Florida, Center for Tropical Agriculture. Lorin E. Harris. February 1970. 352 pages.

PB–216 272

Electronic computers now make it possible to balance the diet of farm animals for 25 or more nutrients simultaneously through linear programming techniques. But first the composition of the feed must be determined. This report describes procedures for chemical and biological analyses of the samples of feed. It also outlines a record keeping system for a nutrition laboratory and an international terminology or feed terms. A list of the terms in English to Spanish and in Spanish to English is presented, in addition to definitions of the terms in both languages.

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ROCK PHOSPHATES FOR FLOODED RICE: AN AGRONOMIC—ECONOMIC ANALYSIS

Tennessee Valley Authority, Soils and Fertilizers Research Branch. O. P. Engelstad. January 1971. 38 pages.

PB–216 283

Over the years, considerable debate has been devoted to the question of rock phosphates versus acidulated phosphates as fertilizers for certain regions of the developing world. While it is generally accepted that the various water-soluble phosphates are suitable for a wide spectrum of soil and crop conditions, there are ancient situations where rock phosphates are often satisfactory. This report concerns efforts to determine the suitability of rock phosphate fertilizers for flooded rice grown on acid soils. Data are presented which were obtained in laboratory and greenhouse trials using various rock phosphates; and an agronomic- economic analysis is presented of rice yield data obtained with some of these same phosphates in Thailand. A close relationship was found to exist between rice yield response to applied phosphorus and citrate solubility of rock phosphates. A procedure is presented which enables one to make the choice of phosphorus source on the basis of both agronomic effectiveness and ratios of prices at the farmer level. Disadvantages associated with rock phosphates, such as low analysis and often lower limiting yield levels, are also discussed.

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GROWTH OF FERTILIZER USE IN INDIAN AGRICULTURE: PAST TRENDS AND FUTURE DEMAND

Cornell University, New York State College of Agriculture and Life Sciences. Gunvant M. Desai. June 1971. 150 pages.

PB–216 793

Growth in world agricultural production has become increasingly dependent on greater use of inorganic fertilizers. In recent years many investigators have recommended such increase in India, a land in which most of the available arable areas are already under cultivation. The report follows extensive tours of the author in key districts in India for study of each important type of farming region and statistical analysis of individual farms. Some of the materials covered are historical perspective, fertilizer needs and demands, fertilizer use practices, patterns of nitrogen use, factors in variations, and forecasting. Much of the data appears in tabular and graphic form.

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INTERACTION OF TECHNOLOGICAL CHANGE AND IRRIGATION IN DETERMINING FARM RESOURCE USE, JABALPUR DISTRICT, INDIA 1967-68

Cornell University, New York State College of Agriculture and Life Sciences. V. P. Shukla. July 1971. 76 pages.

PB–216 795

The level of agricultural productivity in Madhya Pradesh is low and the state of agricultural technology has been relatively static, despite considerable governmental efforts to increase farm resources. The state is in a cycle where backward agriculture is both the cause and effect of low income. This document concerns a study which was made of 172 farms in Jabalpur District, Madhya Pradesh, in an effort to examine the causes of low income agriculture and to seek promising possibilities for improving conditions. Data on the existing resource structures, cost, and income were obtained through a farm survey. Linear programming was the basic analytical technique used. For each of several category of farms, the possibility of increasing income by reallocation of existing resources was studied. The effect on income of increasing resources, such as operating capital and irrigated area, was examined. Consideration was also given to the effect of weather changes in relation to present and programmed allocation resources. Finally, the extent of income gain by technological change and the necessary resource expansion was determined.

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A LITERATURE REVIEW AND RESEARCH RECOMMENDATIONS ON CASSAVA

University of Georgia. C. H. Hendershott, J. C. Ayres, S. J. Brannen, *et al.* March 1972. 338 pages.

PB–216 797

Cassava (*Manihot esculenta Crantz*) is a shrubby perrenial plant cultivated primarily for its tuberous roots as food, but young shoots and leaves are also edible. Its substance is known about the world as yuca, macacheira, manioc, or tapioca. The root crop is the seventh largest producer of staple food in the world, grown all over the tropical regions, with increasing quantities being consumed in industry and livestock feeding outside the tropics. Recently an advisory panel on world food supply has recommended that in the vast uncultivated lands, particularly Latin America and Africa, the crop potential of cassava should be analyzed and utilized. The report discusses many areas in this regard: The botany of the plant, its high caloric content and all season growth, its low cost of production and disease resistance, the food products obtained, processing, marketing, and potentials. An extensive review of the literature is given, and a bibliography of 847 entries is included.

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SOIL ACIDITY AND RESPONSE TO LIMING

North Carolina State University, Agriculture Experiment Station. E. J. Kamprath. October 1967. 25 pages.

PB–216 798

Soils in humid regions are ordinarily quite acid throughout the profile. Without the application of lime, the growth of many plants on these soils is reduced and the efficient use of fertilizer is decreased. This document discusses current ideas of soils acidity and plant growth response to liming. Consideration is given to exchangeable acidity; nonexchangeable acidity; measurement of soil acidity; aluminum and manganese toxicity; magnesium, calcium, and molybdenum deficiency; neutralization of soil acidity; growth as related to percent Aʟ saturation in mineral soils and in high organic matter soils; and lime recommendations.

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SOIL TEST INTERPRETATION STUDIES: LABORATORY AND POTTED PLANT

North Carolina State University, Agricultural Experiment Station. D. L. Waugh, and J. W. Fitts. December 1966. 38 pages.

PB–216 799

Soil analysis is a valuable source of information for use in soil management; however, the analysis must be correctly interpreted to be useful. This document presents simplified methods of obtaining data for use in the interpretation of soil tests and thereby help in the fertilizer recommendations made to farmers. The philosophy is followed that certain information about the soil should be obtained first in the laboratory, and then tested in potted plant studies. Data from the potted plant studies aid in the selection of a suitable method of analysis and indicate critical levels of a nutrient in the soil below which proper use of fertilizer containing that element should be profitable.

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A RAPID METHOD FOR CORRELATION OF SOIL TEST ANALYSES WITH PLANT RESPONSE DATA

North Carolina State University, Agricultural Experiment Station. Robert B. Cate, Jr., and Larry A. Nelson. July 1965. 26 pages.

PB–216 815

One of the problems encountered in soil testing is the interpretation of the results obtained. This is necessary before good use can be made of any soil testing procedure, and it is essential if a comparison is to be made between one procedure and another. Soil tests can be calibrated in several ways. One common procedure is the correlation of soil test values with the increase yield of plants supplied with the nutrient being studied. This document describes an improved method of representing the relationship between soil test values and percentage yield values. The method is computationally less involved than other highly precise methods, which is an important advantage where sophisticated computing equipment is not readily accessible. (The text of this document is repeated in English, Spanish, and Portuguese.)

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SOIL TEST INTERPRETATION STUDIES: FIELD TRIALS

North Carolina State University, Agriculture Experiment Station. A. H. Hunter, J. W. Fitts. November 1966. 48 pages.

PB–216 818

Soil analysis is a means of obtaining information relative to nutrient deficiencies and adverse soil conditions on specific areas of land, especially the individual fields of a farm. There are generally three steps in obtaining data for interpretation of soil analysis from an agronomic viewpoint: (1) Laboratory data, (2) potted plant studies, and (3) field trials. This document is concerned with the field trial phase. It outlines some field procedures and suggests treatments that can be used in the field experiments to obtain soil analysis interpretation data for confirming or adjusting the previously determined nutrient level "critical level." Procedures are presented for selecting field sites for conducting trials. Finally, techniques are discussed for conducting field trials and for summarizing and publicizing the data.

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GROWTH LINKAGES OF THE NEW FOODGRAIN TECHNOLOGIES

Cornell University, Department of Agricultural Economics. John W. Mellor and Uma J. Lele. May 1972. 32 pages.

PB–218 127

Successful introduction of new high-yielding foodgrain varieties substantially increases the income of farm owners, thereby raising a potential for increased production, with concomitant increase in employment. In most low-income economies, such as India, the laboring classes demand food grain more than any other commodity, while the demand of the upper-income rural people is relatively low. An increased food grain production with increased income, and an increased food grain demand with increased employment, although creating a complex set of linkages, would appear to favor the growth of the high yield grains in a low-income economy. The report presents considerable expenditure data for India in the 1960s for rural and urban populations, for commodities, statistical distributions, and classes of persons. The possibilities for both balances and imbalances are discussed.

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LATIN AMERICAN TABLES OF FEED COMPOSITION

University of Florida. Wm. C. Christiansen, Jenny Eggleston, Lee R. McDowell, Joe H. Conrad, and Lorin E. Harris. June 1972. 266 pages.

PB–218 129

Tables of livestock and poultry feedstuffs are presented with the aim of recording in one publication the information available for a given feed. Scientific names are used as the principal identification, with common, local, and area names included for cross reference. The publication is expected to be of assistance to feed manufacturers, research specialists, teachers, students, extension specialists, farmers, and others concerned with formulating livestock and poultry rations in Latin America. It will aid in identifying and describing feedstuffs for which data are limited or lacking. Analyses are given for most countries of Latin America, plus some data from the United States and Canada.

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PLANNING KOREA'S AGRICULTURAL DEVELOPMENT

U.S. Department of Agriculture, Foreign Economic Development Service. W. R. Gasser, J. P. Calvin, R. S. Magleby, E. S. Micka, T. Mullins, and C. A. Breitenbach. August 1970. 110 pages.

PB–218 232

The population of the Republic of Korea is expected to exceed 35 million by 1976, a gain of about 13% over the 1969 figure. In the same period, the Gross National Product in real terms is projected to increase more than 80%, with income per capita showing a gain of about 78%. This population and income growth will generate a rapid rise in the demand for food, requiring an expansion of 25% to 30% of the total supply of farm products. This report contains a series of recommendations concerning steps that may be taken to effect this expansion in the areas of agricultural production and marketing. Consideration is given to the general improvement of long-range projections, livestock improvement plans, problems relating to grains, evaluation of marketing needs, and proposed reorganization for economic research.

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IMPORTS AND PLANTING OF HIGH- YIELDING VARIETIES OF WHEAT AND RICE IN THE LESS DEVELOPED NATIONS

U.S. Department of Agriculture, Foreign Economic Development Service. Dana G. Dalrymple. January 1971. 48 pages.

PB–218 233

The use of new high-yielding varieties of wheat and rice was expanded sharply in the less developed world in recent years. The purpose of this report is to document as completely as possible the quantitative growth in cultivation of these varieties. It reports tonnage of seed imported and area planted or harvested. The report basically consists of three sets of tables for the non-Communist nations. The first two indicate imports and area planted by country and crop year for wheat and rice; each is followed by an extensive set of footnotes and references. The third set of tables summarizes the area information. The tables are preceded by a discussion of the origin of high-yielding wheat and rice varieties and followed by an appendix which reviews the development of improved rice varieties in Communist nations (Mainland China, North Vietnam, and Cuba).

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GROWTH OF FERTILIZER USE IN INDIAN AGRICULTURE. PAST TRENDS AND FUTURE DEMAND

Cornell University, New York State College of Agriculture and Life Sciences. Gunvant M. Desai. 1970. 148 pages.

PB–218 775

Most of the available land in India is now under cultivation; thus the needed growth in agricultural productivity must come from more intensive cultivation. The increased use of fertilizer is a key element in the attainment of this goal. In this study, the growth of inorganic fertilizer use in India, the role played by the government in initiating and promoting its use, and the importance given to fertilizer in the agriculture production programs of the Five Year Plan are reviewed. The need-based targets of fertilizer are presented and the problems involved in raising levels of use to the target levels are discussed. Past fertilizer use pattern is analyzed on three levels—individual cultivators, districts, and states. Consideration is given to the past use pattern, the factors behind it, and their relative importance in determining the growth in demand for fertilizers. Estimates are provided of the growth in demand for nitrogenous fertilizers in the various states, the main difficulties in sustaining rapid growth are discussed, and the nature of the public policy needed to generate continuous rapid growth in cultivator's demand for fertilizers is indicated.

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RATE OF ADOPTION OF NEW FARM PRACTICES IN THE CENTRAL PLAINS, THAILAND

Cornell University, Department of Agricultural Economics; and Kasetsart University Department of Agricultural Economics. Brook A. Greene. October 1970. 211 pages.

PB–218 779

The agricultural sector of Thailand includes at least 75 percent of the population. This fact, as well as the dynamic change occurring in methods of production, makes this sector of major interest to policy makers. This document explores the interrelationships between socio-economic variables and the spreading use of new farm practices. The new practices considered are: Use of synthetic fertilizer, contract tractor plowing, water pumps, insecticide, herbicide, crab killer, and rice double croppings. The data which forms the basis of the report were collected in Chainat Province and were of two basic kinds: Economic cost and return, and socio-economic data on each of the seven new farm practices. Emphasis is given to the great variety of diffusion patterns as innovations of differing characteristics interact within varying environments, and to the complex interactions of economic and social factors influencing adoption of innovation.

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LIVESTOCK FEEDS AND FEEDING IN LATIN AMERICA

University of Florida, Institute of Food and Agricultural Science. William C. Christiansen. April 1971. 140 pages.

PB–218 780

In recent years expansion in livestock production has been considered a desirable goal in the economic development of many Latin American countries. This report summarizes the overall status of livestock production in Latin America and presents an approach for animal agricultural development for less developed countries. The approach presented is the so-called "total package" concept where all the limiting factors to production improvement are dealt with simultaneously and with relative equal emphasis. Attention is drawn to the present status as well as the development potential of Latin American livestock production. Grasslands and

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their production of forages and forage utilization by beef cattle receive special attention. The report is intended to serve as a guide for planning and implementing livestock development projects.

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CHANGES IN AGRICULTURAL PRODUCTION IN BRAZIL, 1947-65

U.S. Department of Agriculture, Economic Research Service. Louis F. Herrmann. June 1972. 97 pages.

PB–218 784

This document considers factors related to changes in Brazil's agricultural output and productivity, with emphasis on the period 1947-65. Attention is focused on the nation's great potential for expanding the area under cultivation, problems of soil fertility, conditions determining the balance between traditional and modern techniques, and general economic background. From the analysis of these and other factors, including livestock numbers and crop and livestock yields, suggestions are made for facilitating further development. Since many of the conditions that exist in Brazil prevail elsewhere in the world, the results of this study can also be used in planning agricultural and economic development programs in other developing countries, particularly those still having unused land for development.

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Fisheries

GULF AND CARIBBEAN FISHERIES INSTITUTE. PROCEEDINGS OF THE 24TH ANNUAL SESSION—MIAMI, FLORIDA

University of Miami, Rosenstiel School of Marine and Atmospheric Science. James B. Higman (Editor). May 1972. 153 pages.

COM–72–11408

Twenty-one papers which were presented at the conference are contained in this report. Some of the topics covered include: U.S. national fisheries policy; foreign fishing off the Southeastern U.S.; management of fishery resources for optimum returns; pollution management; compatibility of fisheries and petroleum activities in the coastal zone; coastal zone management; conflict of coastal resources and urban, industrial, and agricultural development; regulation of contaminants in fisheries products; the heavy metals problem in seafoods; microbial contamination of shrimp products; fish poisoning in the Eastern Caribbean; design of aquacultural enterprises; lobster fishing industry of Bequia Island, West Indies, future of the Gulf Menhaden fishery.

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INSULATING ICE BUNKERS AND FISH HOLDS OF OLDER FISHING VESSELS

University of North Carolina. Norman B. Angel. July 1972. 19 pages.

COM–72–11431

One of the serious limitations of many older commercial fishing vessels is their ice holding and fish keeping capabilities. The lack of insulation of the ice bunkers and fish holds is the primary reason for this limitation. The addition of effective insulation to these vessels would reduce operating costs by reducing ice consumption, extend the time and range at which the vessel could operate, and improve the quality of a delivered catch. This document describes the installation of an insulation system which has proven successful in actual practice. It employs spray-in-place polyurethane foam insulation with exterior-grade plywood sheet liners. The system does not require highly skilled labor for installation. Also, the time that the vessel is out of service during installation is minimal.

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HOW TO PLAN AND CUT NETS

University of Rhode Island. Albert J. Hillier. September 1972. 13 pages.

COM–73–10141

Fishing nets have been in use for centuries, but information on them is still incomplete. The report is concerned with midwater and bottom nets used in the world's fisheries, in which the belly, square, wing, or jib sections vary in mesh size and dimensions. It appears that most netbuilders have developed their own methods of tapering these sections, but nowhere can one find an explanation of how the taper figures were derived. A formula has been developed for determining any taper desired for a net or trawl section. The basis is a body cutting formula, with a variation called the jib formula, involving right angles, 45 deg angles, and angles greater than 45 degrees. Some working examples are cited, and a number of mesh diagrams are given.

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CHARTWORK FOR FISHERMEN AND BOAT OPERATORS

University of Rhode Island. G. A. Motte. 1972. 92 pages.

COM–73–10221

In general terms, chartwork is used to plot a ship's progress in sight of land, whereas navigation applies to ships out of sight of land. Chartwork applies basic geometric theories to ship courses, speed, bearing, and position lines, while the charts themselves may become by circumstance the most important equipment aboard ship. The document is a guide and textbook, containing definitions, instructions, and exercises to be worked out, with answers in the back. Discussions are provided of care and types of charts, fixing positions, chart reading and course plotting, allowances for wind and tide, sextant operation, operation of lights, sounding, sailing, and compass use.

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DEVELOPMENT OF A PROCESS FOR PREPARING A FISH PROTEIN CONCENTRATE WHICH CAN BE RECONSTITUTED INTO A MEAT-LIKE PRODUCT

Texas A and M University, Department of Animal Science. Kamaluddin Hyder, and Bryant F. Cobb, III. March 1972. 102 pages.

COM–73–10411

Harvesting of unutilized and underutilized marine species and the development of products for direct human consumption is one of the most productive areas for solving the world food problem and alleviating the protein malnutrition in undernourished populations. Fish protein concentrate is one possible means of utilizing the otherwise unwanted fish which appear in commercial fishing hauls. However, the absence of dehydration and emulsifying capacities of fish protein concentrate has hitherto limited its use as a human nutritional food supplement. A process for preparing fish protein concentrate with dehydration and emulsifying properties has now been developed, and is described in this report. These properties are maintained by pH adjustment to prevent protein-protein interaction during hot solvent extraction processes. The product has the following qualities: Amino acid spectrum similar to that of fish muscle; bacteriologically sterile; water retention capacity of at least twice that of the original fish muscle; forms emulsions in oil-water mixtures; has high protein efficiency ratio; appears useful as a binder protein in sausage-like products; and forms milk-like suspensions. A partially refined fish oil is obtained as a coproduct.

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MAKING FISH PROTEIN CONCENTRATES BY ENZYMATIC HYDROLYSIS. A STATUS REPORT ON RESEARCH AND SOME PROCESSES AND PRODUCTS STUDIED BY NMFS

National Marine Fisheries Service. Malcolm B. Hale. November 1972. 41 pages.

COM–73–50080

Fish protein concentrates (FPC) are products derived from fish by processes in which the fish protein is placed in a more highly concentrated and stable form. Added in low concentration they can markedly improve the nutritive value of many common foods. Most FPC is now produced by a solvent extraction method. An alternate method, which employs enzymatic hydrolysis, has a number of potential advantages over solvent extraction. These include the fact that the product can have special properties, such as solubility, which makes it more suitable for certain applications than solvent extracted FPC; it may prove to be a less expensive process; and it is more suitable for use on shipboard or on a small scale in remote areas. This report summarizes research that has been carried out by the National Marine Fisheries Service on enzymatic methods. Processes were developed for the preparation of a totally-soluble FPC with good nutritive value through the hydrolysis of whole fish, and a partially soluble product from fish press cake. A literature survey of fish protein modifications by related biological and hydrolysis methods is included.

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THE STATUS OF DEVELOPMENT OF MAIZE WITH IMPROVED PROTEIN QUALITY

Purdue University, Agricultural Experiment Station. L. F. Bauman and E. T. Mertz. April 1972. 7 pages.

PB–216 273

The protein in ordinary maize has relatively low nutritional value. In 1964 Mertz, Bates, and Nelson reported that the *opaque-2* gene improved protein quality markedly by increasing the content of several nutritionally limiting amino acids. Nutritional studies confirmed the potential value of *opaque-2* maize in helping to solve the world's human and animal nutritional needs. There were several deficiencies associated with this maize, including those associated with yield, disease susceptibility, harvest, storage, and consumer acceptability, that remained to be solved. This document presents a summary of the results of recent work on the development of high quality protein in maize. Consideration is given to analytical and nutritional aspects first, then breeding and genetics.

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A PRACTICAL APPROACH TO THE LYSINE AND TRYPTOPHAN SUPPLEMENTATION OF LIME-TREATED CORN

Rutgers—The State University, Department of Food Science; and Institute of Nutrition of Central America and Panama, Division of Agricultural and Food Science. Ricardo Bressani. December 1970. 62 pages.

PB–217 742

In countries where the diet is substantially corn (*i.e.,* where corn provides 70-80% of the daily calories and protein), a significant nutrition improvement could possibly occur through the manipulation of this important food in the diet, hopefully without incurring any change in the dietary habits of the people. One approach to this end involves the fortification of corn by the addition of additional protein and the limiting amino acids. This document provides the results of research which indicate that the addition of lysine and tryptophan to corn and/or the addition of lysine plus soy or milk as sources of tryptophan is technically feasible and gives a satisfactory product. Moreover, this approach can be compatible with existing market distribution channels. The specific topics discussed in detail in the document are: Stability of added ysine and tryptophan in crystalline form and in protein during

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tortilla preparation from tortilla flour; improvement of the protein quality of lime treated corn masa with supplements rich in lysine and tryptophan. Practical methods for the fortification of corn with proteins or amino acids; formulation and cost comparison of corn fortification mixtures; acceptability of tortillas fortified with lysine and soy.

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Industrial and General Economic Development

AN ANALYSIS OF THE PATTERNS OF ARGENTINE ECONOMIC DEVELOPMENT

Naval Postgraduate School. Robert J. Beckman. June 1972. 104 pages.

AD–753 606

This document examines the course of economic development in Argentina, from both a historical and theoretical point of view, and analyzes the roots and stages of the Argentine development problem. The first section presents an overview of Argentina, with emphasis on the interactions of economic forces, human forces, and policies, and the bearing of these on the development of Argentina from the 19th century to the present. The theoretical aspects of the development pattern are then examined; and an analysis is undertaken of the effects of the various industrial policies brought about by import substitution on the Argentine economy. Finally, the techniques of input-output analysis are used to determine the structure of the Argentine economy if it were to attain a state of self-sufficiency. The analysis focuses on the sectoral strength and weaknesses of the Argentine economy, thereby providing a starting point for developmental progress.

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SIZE OF FIRM AND EFFICIENCY IN COLOMBIAN MANUFACTURING

Williams College, Center for Development Economics. John E. Todd. October 1971. 57 pages.

PB–216 267

One of the areas of controversy among policy makers in the less developed countries is whether large scale manufacturing enterprises are socially more efficient than small and medium size establishments. This report represents a detailed study of this problem with respect to Colombia. It is shown that, in Colombian manufacturing, small and medium size establishments generate more output per unit of scarce resources than large establishments. Both total output and employment would be higher if these firms could acquire a larger share of scarce resources and markets; and, it is argued, there are specific policies available which would achieve this goal without impairing the firms' incentives to grow. It is also shown that such a shift in the composition of manufacturing output by size of firm is not precluded by serious sectoral or regional obstructions.

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ALLOCATING INTEGRATION INDUSTRIES IN THE ANDEAN GROUP

Harvard University, Development Advisory Service. David M. Schydlowsky. January 1971. 17 pages.

PB–216 276

The benefits versus the economic threats of monopolies, in particular, industries, have long been a matter of debate. A new concept in monopolistic enterprise is now being applied in the Andean customs group, consisting of Colombia, Ecuador, Peru, Bolivia, and Chile. It consists of assigning virtual monopoly rights for the production of certain industrial commodities to favored counties within the group. The report discusses the care required in the allocating the benefits to the group as a whole, and the possible skewing of benefits among the several nations. Choice between better and poorer producers is considered, and the export-mport relations between the integration group and the outside world are also examined.

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AID, FOREIGN PRIVATE INVESTMENT, SAVINGS, AND GROWTH IN LESS DEVELOPED COUNTRIES

Harvard University, Foreign Development Group. G. F. Papanek June 1971. 64 pages.

PB–216 279

The effect of foreign resource inflows on the economics of a developing country, especially as related to internal savings, has been a subject of continued difference of opinion. Foreign aid, in paricular, appears to go disproportionately to countries with low per apita incomes, serious balance of payments constraints, and crises of political, social, and economic nature. The report holds that ecent conclusions that foreign aid has a negative effect on savings hould be reexamined; that foreign resources should be considered part from internal developments in calculating growth; and that avings and foreign inflows are often affected by the same exogenus factors, making their correlation unimportant in growth conlusions.

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HARMONIZATION OF ECONOMIC POLICIES IN CUSTOMS UNIONS: THE ANDEAN GROUP

Harvard University, Development Research Group. David Moravetz. December 1971. 48 pages.

PB–216 281

All free trade areas and customs unions of nations must deal with ne question of how far to harmonize the economic policies of the member countries. An examination of the question is made as it elates to the recently formed Andean Group Customs Union comosed of Bolivia, Chile, Colombia, Ecuador, and Peru. The polices analysed for this customs union concern tariffs, export sub-

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(continued)

sidies, indirect taxes, exchange rates, planning and stabilization, intra-union movements, foreign capital, and currency. Some conclusions are drawn, which differ according to the specific type of harmonization involved and the assumptions which have been made regarding other policies.

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ECONOMIC INTERDEPENDENCE IN SOUTHEAST ASIA

University of Wisconsin. March 1970. 194 pages.

PB–216 287

The report reviews research on economic development in Southeast Asia and on economic cooperation by the Agency for International Development within the region. The objectives of the research were: (1) to evaluate the economic advantages to countries of the region from economic cooperation and coordination; (2) to assess the theory and experience of economic growth and of common market and free trade association ventures as compared with Southeast Asian possibilities; (3) to assess the extent to which national plans have implications or specifications with respect to economic integration in the area, and the extent to which success or failures in implementation have had any systematic relation to regional economic interest; and (4) to indicate future AID strategy with respect to regional economic cooperation. Summary data and policy implications are presented.

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NATIONAL PLANNING AND ECONOMIC DEVELOPMENT—A CRITICAL REVIEW OF THE JAPANESE EXPERIENCE

Harvard University, Center for International Affairs. Tsunehiko Watanabe. November 1970. 52 pages.

PB–216 288

National planning can have a beneficial effect on the economic development of developing countries. This report reviews the experience of one such nation, Japan, by analyzing the effectiveness of eight main national plans. In particular, the existence of persistent overfulfilled targets in the Japanese national planning experience is discussed from the following viewpoints: Has it been mainly due to deficiencies in the methodologies used in the plans; has there been any special reason to produce the persistent underestimations in the quantitative projections; and, if so, how to evaluate the Japanese experience.

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ECONOMIC PROSPECTS FOR THE ANDEAN GROUP

Harvard University, Development Research Group. David Morawetz. May 1972. 35 pages.

PB–216 291

The Andean Group is a collaborative organization of Bolivia, Chile, Colombia, Ecuador, and Peru into a program for economic development. The principle is establishment of a common market, with industrial specialization by the several participating nations. The report discusses some of the major benefits which are expected of the integrative effort, along with some factors which place bounds on success potential, and analyzes some key issues which can decide the extent to which the potential is realized. Such issues include external tariffs, trade liberation, exchange rate policies, allocation of new industry, foreign private investments, and a corporation formed for Andean development. Venezuelan entry into the union is considered. Alternatives to which the integration should be compared are also noted.

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A REPORT ON THE LIPI-NAS WORKSHOP ON NATURAL RESOURCES. VOLUME I

Lembaga Ilmu Pengetahuam Indonesia; U.S. National Academy of Sciences. September 1972. 91 pages.

PB–217 293

The integrated multiple use of resources offers important advantages to developing countries. These opportunities must be evaluated prior to exploitation, for negative factors exist along with positive ones. Forest lands that may supply raw materials may in production damage water resources, for example. The purpose of the workshop was to pool ideas on how to utilize the abundant natural resources of Indonesia in a manner consistent with the needs and expectations of a growing population. Objectives included the indication of policies for planning and utilization, suggestions for scientific and technological inputs, and design of a form for coordinated and constructive view interchanges by key personnel. The problems which were discussed and the recommendations that were made are reported.

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JAPAN'S FOOD DEMAND AND 1985 GRAIN IMPORT PROSPECTS

U.S. Department of Agriculture, Economic Research Service. Joseph R. Barse. June 1969. 108 pages.

PB–216 790

Japan is a rapidly growing market for food exports from both developed and developing nations, which have shared in the grain sales to this market. To better evaluate prospects for the future, it is necessary to know why the Japanese grain market has grown so rapidly in the past and what factors will shape its future growth. Because levels of Japanese food production and consumption per person are lower than in other developed countries, Japan can choose among several food development plans for the next 15 years. This study suggests three alternative food strategies for the future and shows the differences among them. Emphasis throughout is on the possible effects of the strategies on Japan's demand for agricultural imports from less developed countries.

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IMPACT OF THE SONAULI-POKHARA HIGHWAY ON THE REGIONAL INCOME AND AGRICULTURAL PRODUCTIO NOF POKHARA VALLEY, NEPAL

Cornell University, New York State College of Agriculture and Life Sciences. Mark C. W. Schroeder, and Daniel G. Sisler. August 1971. 91 pages.

PB–216 791

The purposes of this study are to provide an analysis of the economy of Pokhara Valley before construction of a road into the valley changed the traditional pattern of farming, and to appraise the effect of improved transportation on that economy. Specific topics included in the analysis are: Pattern of consumption; cropping patterns of Pokhara; trade and commerce; economic effects of improved transportaition; additional components of development; projections of regional income.

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THE MODERNIZATION DECISION IN INDIAN FLUID-MILK MARKETS

Cornell University, New York State College of Agriculture. Ray W. Nightingale. August 1969. 96 pages.

PB–216 792

Economic development brings rising incomes and a consequent major change in the pattern of demand for agricultural commodities. The demand for milk in India grows rapidly with rising incomes. This research analyzes the traditional marketing system for milk in the area near New Delhi and the performance of a set of modern milk plants in various cities in India, while comparing the performance of the two systems. The study helps to clarify the question of the choice of technology in the context of economic development. The salient features of the Indian dairy economy are reviewed, and the potential for improving market performance is considered.

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AGRICULTURAL PRODUCTION AND INDUSTRIAL CAPITAL FORMATION, INDIA, 1951-52 to 1964-65

Cornell University, New York State College of Agriculture. Ujagar S. Bawa. March 1971. 88 pages.

PB–216 796

In the lower income economies it is expected that agriculture, the dominant sector, must have a major influence on the pattern of national capital formation. However, not much information is available on the historical relationship between agricultural production changes and savings, investments, and other sectors of the economy. After an examination of the first three 5-year plans in India, some findings are presented on changes in agricultural production, with emphasis on changes in the weather, savings rates, and investment rates. The various subjects discussed include the structure and sources of industrial capital; the influence of taxes, investment in agriculture, public expenditures, prices and price ratios, wages and raw materials in the cost structure; government activities; and direct relationships in the public and private sectors. A statistical model is presented, and considerable econometric data are given in graphic and tabular form.

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AN ANALYSIS OF MODERNIZATION OF THE RICE MILLNG INDUSTRY IN INDIA

Cornell University, Department of Agricultural Economics. Uma J. Lele. June 1970. 52 pages.

PB–216 816

In India increased attention has recently been devoted to modernizing the rice milling technology. Among the problems confronting this effort are the low quality of paddy, or threshed rice as received from the fields, lack of adequate protection afforded by traditional storage methods, and outdated milling machinery which at best gives an outturn of 68 percent. The report discusses the factors which determine efficiency of the rice milling industry, examines the operation of two modern rice mills, and considers the question of improvement of storage facilities. Modernization is seen as centered around the most desirable size of mills to be established, with evidence pointing toward small mills utilized close to capacity as the optimal system. Statistical data are presented, along with an analysis of efficiency, policies, costs, and milling structures.

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WORLD DEMAND PROSPECTS FOR AGRICULTURAL EXPORTS OF LESS DEVELOPED COUNTRIES IN 1980

U.S. Department of Agriculture, Economic Research Service. June 1970. 66 pages.

PB–216 817

World supply, demand, and trade of wheat, rice, coarse grains, oilseeds, cotton, bananas, and beverage crops are projected to 1980 under three basic alternative sets regarding economic development, production growth rates of commodities, and policies of major developed trading countries. General implications drawn from commodity projections are: Supplies of most foods and fibers appear likely to exceed demand at 1970 prices; demand of less developed countries for agricultural imports may increase rapidly; increased exports of commodities with an inelastic price elasticity of demand may be associated with lower export earnings; less developed countries earnings from commodities supplied by both less developed countries and developed exporters can be drastically affected by policies of developed exporters; less developed countries may find it difficult to achieve a consensus on trade policy.

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WORLD DEMAND PROSPECTS FOR BANANAS IN 1980, WITH EMPHASIS ON TRADE BY LESS DEVELOPED COUNTRIES

U.S. Department of Agriculture, Economic Research Service. Arthur B. Mackie, and Jon E. Falck. February 1971. 101 pages.

PB–217 739

Bananas are of strategic importance in several developing countries They represent an important source of foreign exchange in the 18 countries which export substantial quantities. This report is concerned with the future demand prospects of bananas. Specifically, it provides an estimate of the long-term prospects of bananas as an export earner of foreign exchange in those countries presently producing or contemplating producing bananas. In ascertaining the prospects for export earnings, major attention is given to the analysis of demand in importing countries and, to a lesser degree, to the supply and demand in producing countries.

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WORLD DEMAND PROSPECTS FOR COTTON IN 1980, WITH EMPHASIS ON TRADE BY LESS DEVELOPED COUNTRIES

U.S. Department of Agriculture, Economic Research Service. Richard S. Magleby, and Edmond Missiaen. January 1971. 170 pages.

PB–217 740

Cotton is a major source of foreign exchange earnings for many less developed countries. It is an important earner or a potential earner in many others. Exports of cotton textiles are also a significant source of earnings for several less developed cotton-producing countries. This report examines the demand prospects and, to a lesser extent, supply sources of cotton. Particular attention is given to: Anticipated expansion in future world cotton consumption (as positively affected by increasing population and income, and negatively affected by competition from manmade fibers); the import needs of major cotton deficit regions; the form in which these import needs will be met, and the role of cotton textiles; the future cotton lint-cotton textile trade mix; the source from which these import needs will be satisfied and the changes in trade flows to be expected.

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ANALYSIS OF CAPITAL FORMATION AND TECHNOLOGICAL INNOVATION AT THE FARM LEVEL IN LDC's. SECOND ANNUAL REPORT

Ohio State University, Department of Agricultural Economics and Rural Sociology. Norman Rask. July 1971. 63 pages.

PB–218 126

ANALYSIS OF CAPITAL FORMATION AND TECHNOLOGICAL INNOVATION AT THE FARM LEVEL IN LDC's. THIRD ANNUAL REPORT

Ohio State University, Department of Agricultural Economics and Rural Sociology. Norman Rask, and Richard L. Meyer. July 1972. 49 pages.

PB–218 125

In most less-developed countries, significant increases in agricultural production must depend largely on two interrelated processes: (1) The build-up of farm resource productive capacity (*i.e.,* capital formation), and (2) The development and introduction of technological changes in agriculture. These reports concern the results obtained thus far in a continuing project involving the investigation and description of capital formation and utilization at the farm level, including the impact of technological change on the need for capital and on the capital formation; and the evaluation of the implication and impact of selected policies designed to stimulate capital formation. The work is based largely from data collected in Brazil and, to a lesser extent, on data available from India.

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MONASTERY MODEL OF DEVELOPMENT: TOWARDS A STRATEGY OF LARGE SCALE PLANNED CHANGE

Colorado State University. Garth N. Jones. November 1971. 80 pages.

PB–218 128

The more serious economic problems about the world are expected to be located in the lesser developed countries, since major social changes are needed to support an advancing technology, and a traditional closed group psychology requires especial direction. The monastery, or self-contained entity, approach is suggested for such nations, following the pattern of historical religious groups which severed themselves from a hostile or unfavorable environment and established successful systems. Examples cited are monasteries in the lowlands, swamps, and remote places, of Europe where useless land was converted to fertile farms; the Mormons who migrated to isolation in western America, and the Essene Jews who withdrew into the desert, among others. The British are seen to have used the system in colonial rule. The report explains that the monastery model will function only when the significant social variables are systemetized into a repetitive pattern, after which importation of industrial technology becomes feasible. Five interlocking essential system aspects are discussed, and the results are applied to illustrative developments as a model city, a company town, and a large corporation. System change considerations are underlined through all such developments.

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Technology Transfer and Utilization

CIVILIZING SCIENCE AND DISCIPLINING ITS MANAGEMENT

Science Communication, Inc. DeWitt O. Myatt. December 1972. 37 pages.

AD–754 968

Sound management of a nation's science resources in today's world requires effective linkages between maangement people and scientists. However, some shortcomings exist, both in defining the resource inventory for management maintenance, and inventory access for scientists and technologists. The report considers potentials for collaboration by managers and scientists to eliminate these shortcomings. Professional and technical personnel are able to construct the needed inventory, while managers and decision makers have the machinery for making it effective. A discussion is made of social factors, data handling, and the attitudes involved, and suggestions are advanced for a research and development resource management system with organic integrity.

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AN INTRODUCTION TO TECHNOLOGICAL FORECASTING

Construction Engineering Research Laboratory. William J. Pananos. February 1973. 9 pages.

AD–755 523

Technological forecasting is a technique of scientific management which emerged during the early 1960's as a tool for use in research and development planning and management. This report describes, for the benefit of persons engaged in planning, what technological forecasting is and how it is used. Consideration is given to forecasting techniques, applications of technological forecasting, the relationship between planning and forecasting, controllable and uncontrollable variables, and the distinction between planning and forecasting.

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USEFUL NEW TECHNOLOGY AVAILABLE TO TO INDUSTRY AND OTHER GROUPS

National Aeronautics and Space Administration, Technology Utilization Program. 1972. 17 pages.

N72–29846

The tangible benefits of space technology have been manifold. Industry has utilized developments originating from the space program to improve production processes and product reliability, and to provide new non-aerospace products and services to customers. New products for both business and the consumer have been developed. In other cases individuals benefit directly from the application of space programs, such as those involving meteorological, communication, and earth resources satellites. This document describes NASA's efforts to transfer the technology generated and developed through its space programs to non-space applications. A summary of the Technology Utilization Program is given, and examples of some specific benefits to industry are described. More importantly, instructions are provided on how interested parties may share in the technology available from NASA.

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NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION I, ABSTRACTS

National Aeronautics and Space Administration, Office of Industry Affairs and Technology Utilization. January 1972. 557 pages.

N72–29969

NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION II, INDEXES

National Aeronautics and Space Administration, Office of Industry Affairs and Technology Utilization. January 1972. 331 pages.

N72–29970

Several thousand inventions result each year from the aeronautical and space research supported by NASA. The inventions having important use in government programs or significant commercial potential are usually patented by NASA. These inventions cover practically all fields of technology and include many that have useful and valuable commercial application. Section I of this bibliography contains comprehensive abstracts of 1892 patents and patent applications. Each entry is accompanied by a key illustration of the invention. Section 2 is comprised of subject, inventor, corporate author, and number indexes. Many of the patents are available for foreign licensing.

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SPACE FOR MANKIND'S BENEFIT

National Aeronautics and Space Administration, Scientific and Technical Information Office. Jesco von Puttkamer, and Thomas J. McCullough (Editors). 1972. 460 pages.

N73–13829

This document is comprised of papers presented at the first international Congress on "Space for Mankind's Benefit," which was held at Huntsville, Alabama, 15-19 November 1972. The papers are authored by experts in their respective areas of space technology applications. The general subject areas covered include: Major space program elements from which space applications on earth will derive; fundamental benefits of the space program; benefits of orbital surveys and space technology to environmental protection; earth resources observation through orbital surveys; benefits to medicine, medical technology, and biotechnology; benefits to telecommunications, navigation, and information systems, meaning of space exploration and space technology to the natural sciences; space manufacturing benefits; benefits to future power generation and energy production; general technology utilization in the public sector (housing, transportation, education, etc.); social benefits and international cooperation through space.

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INFORMATION RETRIEVAL

National Archives and Records Service. 1972. 135 pages.

PB–214 335

An information explosion is now overtaxing conventional methods and equipment for indexing and storing the thousands of new documents being prepared each year. As a result, management everywhere is being increasingly pressed to automate the files, to adopt new or unconventional methods and facilities which can improve the dissemination, storage and retrieval of data. The handbook is designed to provide some guidelines for determining where the new systems might be employed, and to furnish some criteria for making selections. The several chapters cover such materials as how coordinate indexing works, microform systems, manual nonconventional indexing, nonconventional machine indexing retrieval systems, how to decide if a new system is needed, how to determine system requirements, and designing a coordinate index.

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RANN PROGRAM: POTENTIAL BENEFITS TO DEVELOPING COUNTRIES

Agency for International Development, Office of Science and Technology. Harry Y. H. Choi. January 1973. 46 pages.

PB–214 862

The Research Applied to National Needs (RANN) programs of the U.S. National Science Foundation are aimed at focusing U.S. scientific resources on selected problems of national importance. RANN places special emphasis on problems of improving productivity and economic growth, and the quality of the environment and life. The scope and orientation of RANN programs toward areas which hold promise of technological, social, or economic pay-off through the application of scientific knowledge, suggest that results from some of these programs might be useful also in the developing countries. This report identifies 48 individual RANN projects that could have special relevance to the needs of the developing countries. It clarifies their technical significance to these countries and illustrates possible types of spin-off benefits.

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TECHNICAL CHANGE AND THE DISTRIBUTION OF INCOME IN RURAL AREAS

Harvard University, Development Research Group. Carl H. Gotsch. December 1971. 54 pages.

PB–216 270

The impact of technological change upon the social structure of an economy has not been accorded the consideration in technological planning which it now appears it should have been given. Recently more attention is being devoted to the ways in which technology and institutions interact through time, particularly in rural areas where the effects appear to become more severe. It is argued that the distributive effects of technical change cannot be predicted except in the context of the rural community structures. The considerations seen as fundamental are efficiency and factor intensity, asset assessment, type and distribution of services, and local customs and traditions. An analysis is made by using one innovation, the tubewell, to examine effects on the distribution of income and power in rural communities of east and west Pakistan. Several generalizations are made on the effectiveness of rural development policies and programs.

----o----

DIFFUSION OF INNOVATIONS IN BRAZIL, NIGERIA, AND INDIA

Michigan State University, Department of Communication. Everett M. Rogers, Joseph R. Ascroft, and Niels G. Roling. 1970. 391 pages.

PB–216 275

The report presents the results of a cross-cultural comparative investigation of the diffusion of innovations to peasant farmers in Brazil, Nigeria, and India. Innovations in agriculture, health, and family planning were studied. The variables of village, leader, and change agent were related to agricultural change. It was found that change agent variables were most highly related to program success; change agent contact was one of the best, consistent predictors of innovativeness. Furthermore, change agent contact and opinion leadership were more highly interrelated in modern villages than in traditional villages. Also, the efficiency of radio forums in diffusing innovations is much greater than for either literacy-reading classes or community newspapers.

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WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH. VOLUME I, OVERALL FINDINGS AND RECOMMENDATIONS

Lembaga Ilmu Pengetahuan Indonesia; and U.S. National Academy of Sciences. January 1971. 37 pages.

PB–217 118

WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH. VOLUME II, PLENARY SESSIONS AND WORKING GROUPS REPORT

Lembaga Ilmu Pengetahuan Indonesia; and U.S. National Academy of Sciences. January 1971. 68 pages.

PB–218 724

This report was issued as a result of a workshop, held in Djakarta 25-30 January 1971, to formulate matters on industrial research in Indonesia and to make recommendations thereupon to the Indonesian Government. The recommendations are intended to provide a means of motivating, orientating, and developing research activities; and for building the research, development, and engineering (R, D, and E) infrastructure that is needed for an effective contribution to national goals for both general and industrial development. The topics covered in Volume I include findings and recommendations in the following areas: Planning R, D, and E programs in relation to overall development strategy in Indonesia; the industrial and technological research system in Indonesia; problems and plans in selected industries and R, D, and E implications; factors conditioning R, D, and E and the technology transfer process (industrial extension service, standardization and quality control, patents); key factors conditioning the operation of industrial and technological R, D, and E activities in Indonesia (problems facing management; education, training, and career requirements; an information system for R, D, and E; international sources of technical assistance). Volume II contains plenary session and working group reports in these same areas.

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POLICIES AND PROGRAMS IN SELECTED AREAS OF SCIENCE AND TECHNOLOGY

Agency for International Development, Office of Science and Technology. March 1973. 33 pages.

PB–218 816

While technology is but one of the determinants of the rate and direction of industrialization, it is frequently a key determinant as to the competitiveness of products, the commercial viability of processes, and the efficient utilization of capital and manpower resources. This document describes the major components of an AID Program to assist developing countries with selected aspects of the problem of technology transfer and adaptation. It focuses on: Helping developing countries develop national policies and institutions which permit them to make better technological choices, particularly in industry; natural resources assessment and management; and reducing public investment costs.

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INTRODUCTION

Application of Modern Technologies to International Development (AMTID) is published as part of a program being carried out by the U.S. Agency for International Development (US AID) and the National Technical Information Service (NTIS). Its primary objective is to bring certain U.S. technical publications to the attention of interested individuals and organizations in developing countries to foster the transfer of technologies to these countries.

The reports described herein represent the results of research funded by the United States Government. Beginning with this issue, the subject coverage is expanded with emphasis on areas of particular interest in developing countries.

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GLOBAL MARKET SURVEY. AGRICULTURAL MACHINERY AND EQUIPMENT IN DEVELOPING COUNTRIES AND EASTERN EUROPE

U.S. Department of Commerce, Bureau of International Commerce January 1973. 120 pages.

COM–73–50222

An entire series of events, including technological breakthroughs and higher priorities for agriculture during the 1960's, have stepped up agricultural development and output and laid the foundations for even more rapid modernization and growth in the decade ahead. These advances have created a need for more timely and speedy production processes which could be met only with mechanization. Market surveys were conducted recently in 21 countries to pinpoint export opportunities for agricultural machinery. The countries involved, which include the largest and most rapidly growing markets for farm machinery in the developing world and Eastern Europe, are: Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Hungary, Indonesia, Kenya, Malaysia, Mexico, Nicaragua, Panama, Philippines, Tanzania, Thailand, Uganda, Venezuela, and Yugoslavia. This report provides an individual summary of the market survey for each country or trading bloc (Central American Common Market, East African Community). The information given for each country includes: An overview of the market, specific sales opportunities, official programs, local production of farm equipment, duties and trade regulations, sales development, competitive factors, technical factors. The document is oriented toward businessmen in the U. S., but much of the information should be useful elsewhere.

——o——

FACTORS AFFECTING THE ECONOMIC AND SOCIAL WELL-BEING OF AGRICULTURISTS IN LESS-DEVELOPED COUNTRIES

Iowa State University, Center for Agricultural and Rural Development. Roger W. Hexem. September 1971. 421 pages.

PB–215 725

In many developing countries a majority of the people derive their incomes directly or indirectly from agriculture, so that the agricultural sector plays a vital economic role which must be recognized in any national or regional planning. The United States has been providing sizable quantities of food to countries with low per capita supplies, leading to a sometime view that such exporting may be the end in itself. The report contests that view, holding that food support encourages economic development in the recipient country so that it may become self sufficient, or able to import in the world market. It focuses primarily on the productivity of the individual firm. Some of the topics contributing to the discussion are friction points in agricultural development, land tenure, firm size, production techniques, rural credit institutions, marketing systems, the values and attitudes and objectives of agriculturalists as producers and consumers, government policies and programs, and useful mathematical formulations.

DEMAND AND SUPPLY PROJECTIONS OF FOOD GRAINS FOR INDIA, 1970-71 TO 1985-86

Iowa State University, Center for Agricultural and Economic Development; and National Council of Applied Economic Research (India). October 1970. 50 pages.

PB–215 726

In the 1960's, India began new programs and investments in irrigation and other stabilizing techniques of food grain production. The fact that these programs were sufficiently successful to allow a considerable reduction of food imports gave rise to discussion on the potential of balancing food supplies and needs in the near future. In an effort to help illuminate this problem, a study was undertaken to project food grain balances for India through 1985-86. This document summarizes the results of that study. It includes projections of demand for food grains under alternative income elasticities; and it projects food grain supplies using the most recent data and information on fertilizer, new varieties, multiple cropping, and other factors determining future production. It is felt that these projections can provide considerable information for long range planning of agricultural production in India and provide information to assist interested groups in planning future levels of exports to India.

A MICROECONOMETRIC STUDY OF AGRICULTURAL DEVELOPMENT

Ohio State University, Department of Agricultural Economics and Rural Sociology. Richard H. Day, and Inderjit Singh. October 1971. 67 pages.

PB–215 788

It is possible to reasonably state that agricultural development can be fully understood and effectively planned only by accounting for microeconomic aspects of technology, decision strategies, and market environment that play a crucial role in determining economic performance. This document describes the development and testing of a microeconomic model that is capable of simulating the performance of the agricultural sector of an economic system in a way that explicitly accounts for the essential features of technology and decision-making. The general requirements for a dynamic, microeconomic model of agricultural development are first discussed. A mathematical theory is then presented that incorporates the essential features or strategic details of the process. This theory is approximated by an operational model that can be estimated and simulated within existing data and computational limitations. The model is tested against its ability to describe recent agricultural history in the Central Punjab of India. A brief list of applications is provided. Although the operational model, as described in this document, is tailored to the Indian Punjab, suitable modifications should render it applicable to virtually any region undergoing a transition from traditional to modern agriculture.

A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME I. SMALL FARMER CREDIT IN MEXICO AND CENTRAL AMERICA

Agency for International Development. J. U. Salgado, H. D. Gisneros, R. A. Vasquez, R. W. Santos, C. R. Ramirez, *et al.* February 1973. 341 pages.

PB–224 025

This Volume is comprised of five separate reports describing farm credit programs in El Salvador, Honduras, Mexico, and Nicaragua. In each case, consideration is given to program characteristics, program evaluation, and the role of technical assistance. The individual reports are as follows: "Mexico—Rondo de Garantia y Fomento Para la Agricultura, Ganaderia y Agricultura (Guarantee and Development Fund for Agriculture, Livestock, and Poultry)"; "Credit Among Small Farmers—The Case of the Puebla Project of Mexico"; "The Supervised Credit Program Program in El Salvador—1961 to the Present"; "The National Development Bank of Honduras"; "The Rural Credit Program of the National Bank of Nicaragua—Report on Credit to the Small Farmer in Nicaragua."

A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME II. SMALL FARMER CREDIT IN COSTA RICA

Agency for International Development. Albert L. Brown, and Claudio Gonzalez-Vega. February 1973. 183 pages.

PB–224 026

This Volume is comprised of two separate papers describing farm credit programs in Costa Rica. The first paper, "The Agricultural Credit Project of the Agricultural Sector Program of Costa Rica" concerns a search for changes in credit policy and practices which will assure availability of credit to small farmers. The Agricultural Credit Project provides money which is lent to four commercial banks of the National Banking System which re-loan to small farmers. The second paper, "Small Farmer Credit in Costa Rica—the Juntas Rurales", provides a summary of Costa Rica's agricultural patterns and potentials; describes the National Banking System and agricultural credit practices; and then discusses the Juntas Rurales de Credito Agricola, including their history, the evolution of their output, sources of funds, objectives, organization and procedures, and their actual performance during the period 1937-71.

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME III. SMALL FARMER CREDIT IN SOUTH AMERICA

Agency for International Development. O. Carranza, T. C. Royden, C. T. Nesbet, R. L. Meyer, D. W. Adams, N. Rask, and P. F. Cidade de Araujo. February 1973. 272 pages.

PB–224 027

This Volume is comprised of four separate papers describing farm credit programs and practices in Bolivia, Brazil, Chile, and Peru, These papers are the following: "Small Farmer Supervised Credit in Peru", which deals with the program characteristics, evaluation, and technical assistance concerning the Supervised Agricultural Credit Program; "A Review of Small Farmer Credit in Bolivia" covers a review of the history and background of Bolivian agriculture, farm credit characteristics in Bolivia, institutions providing agricultural credit, and case studies; "Instituto de Desarrollo Agropecurio" is concerned with the characteristics, evaluation, and role of technical assistance with respect to this Chilean program; "Rural Capital Markets and Small Farmers in Brazil, 1960-1972" examines the extent to which small farmers in Brazil have participated in the rapid increase in institutional credit during the time period indicated.

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME IV. SMALL FARMER CREDIT IN ECUADOR

Agency for International Development. G. Guzman, J. F. Casals, M. B. Contreras, R. H. Keeler, R. R. Mera, and R. Cruz P. February 1973. 201 pages.

PB–224 028

This Volume is comprised of four separate papers describing farm credit practices and programs in Ecuador. In each case, program characteristics are reviewed and an evaluation of the program is provided. The titles of the individual papers are: "National Development Bank—the Supervised Agricultural Credit Program in Santo Domingo de los Colorados"; "Ministry of Production/ Central Bank Trust Fund—Farm Development Programs in Ecuador"; "The Directed Agricultural Credit Program of the National Federation of Savings and Credit Cooperatives of Ecuador"; "Evaluation of the Directed Agricultural Production Credit Program in Ecuador."

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME V. SMALL FARMER CREDIT IN COLOMBIA

Agency for International Development. J. Schwinden, G. Feaster, D. G. Dallrymple, and R. L. Tinnermeier. February 1973. 207 pages.

PB–223 029

This Volume is comprised of three separate papers describing farm credit programs and practices. In the papers "Small Farmer Credit Activities of the Colombian Agriculture Bank", and "The Incora Supervised Credit Program", program characteristics are outlined, a program evaluation is provided, and the role of technical assistance is discussed. The paper entitled "The Use of INCORA Supervised Credit in 1969" is primarily a compilation of statistical information of the use of credit by 2900 farmers in Colombia who received supervised credit from INCORA in 1969.

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME VI. SMALL FARMER CREDIT IN AFRICA

Agency for International Development. S. Nnebe, A. Ijose, J. N. Abaelu, *et al.* February 1973. 438 pages.

PB–244 030

This Volume is comprised of twelve separate papers discussing farm credit programs and practices in Ghana, Ivory Coast, Morocco, Nigeria, Sudan, Tunisia, Uganda, and Zambia. The titles of the papers are as follows: "Small Agricultural Credit in Ivory Coast—The 'Prets de Soudure' of the B.N.D.A."; "Centre National de Promotion des Enterprises Cooperatives (GENAPEC)" (Ivory Coast); "Institutional Credit for Smallholder Farmers—A Case Study of the Western Nigeria Agricultural Credit Corporation (WNACC)"; "Small Holder Agricultural Credit in Eastern Nigeria—An Analysis of the Fund for Agricultural and Industrial Development"; "Agricultural Credit Strategies for Nigerian

Farmers"; A Review of Small Farmer Credit in Ghana—The Rice and Maize Schemes of the Agricultural Development Bank"; "Organizational Structure and Administrative Procedures Appropriate for Supervised Agricultural Credit Institutions in Developing Countries"; "Government Small-Farmer Credit Programs in Morocco"; "The Local Mutual Credit Union System and Small Farm Credit in Tunisia"; "Small Farmer Credit in Sudan"; "The Cooperative Credit Scheme in Uganda"; "The Role of Money in the Development of Farming in the Mumbwa and Katett Areas of Zambia."

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME VII. SMALL FARMER IN KENYA

Agency for International Development. G. F. Donaldson, J. D. von Pischke, P. Weisel, and M. Hanrahan. February 1973. 268 pages.

PB–224 031

This Volume is comprised of two separate papers describing farm credit programs and practices in Kenya. The first paper, "A Survey of Farm Credit in Kenya", (1) reviews credit provision and requirements in the farm sector; (2) discusses related policy issues and strategies; and (3) details the features of the major institutions and programs providing farm credit in Kenya, including their terms, procedures, and portfolio performance. The second paper, "The Vihiga Maize Credit Program", describes and evaluates a program which provides maize crop inputs (fertilizer, seed, insecticide) to small holders in the Vihiga area.

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME VIII. SMALL FARMER CREDIT IN ETHIOPIA

Agency for International Development. Johan Holmberg, and John M. Cohen. February 1973. 178 pages.

PB–223 032

This Volume is comprised of two separate papers discussing farm credit practices and programs in Ethiopia. The first of these papers, "The Credit Programme of the Chilalo Agricultural Development Unit (CADU) in Ethiopia", describes and evaluates the credit aspects of a coordinated program involving a variety of interrelated agricultural activities. The credit programme is concerned with the selling of fertilizer, wheat seed, agricultural implements, and cattle. The second paper, "The Chilalo Agricultural Development Unit as a Program Intermediary for Foreign Assistance in Ethiopia," is concerned with the following: Role of local institutions and joint organizations in less developed countries as program intermediaries for foreign assistance; rural change in Ethiopia, with special reference to the CADU; CADU as an intermediary organization.

A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME IX. SMALL FARMER CREDIT IN WEST ASIA

Agency for International Development. T. Stickley, S. Satana, M. Hayek, E. Hosseini, D. G. Norvell, R. Mourcade, and Y. Kashshu. February 1973, 354 pages.

PB–224 033

This Volume is comprised of five separate papers describing farm credit programs and practices in Afghanistan, Iran, Jordan, Turkey, and in the Middle East in general. In each case, consideration is given to program characteristics, an evaluation of the program, and the role of technical assistance. The individual papers are: "Small Farmer Credit in Turkey—the Supervised Credit Program of the Turkish Republican Agricultural Bank"; "Small Farmer Credit in Jordan—the Agricultural Credit Corporation of Jordan"; "Small Farmer Credit in Iran—the Supervised Agricultural Credit Program of the Agricultural Cooperative Bank of Iran"; "Agricultural Credit in Afghanistan—a Review of Progress and Problems from 1954 until 1972"; "Agricultural Credit for Small Farmers in the Middle East."

A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME X. SMALL FARMER CREDIT IN SOUTH ASIA

Agency for International Development. M. Solaiman, J. F. Stepanek, D. Myers, *et al.* February 1973. 479 pages.

PB–224 034

This Volume is comprised of eleven separate papers discussing farm credit programs and practices in Bangladesh, India, Pakistan, and Sri Lanka. The titles of the individual papers are as follows: "Small Farm Credit in Bangladesh"; "Comilla (Bangladesh) Cooperative Production Loans—a Note on the Cost of Capital"; "Comilla—Reassessment and Replication, the Cooperative Under Stress"; "The Role of Cooperative Credit in Small Farmer Adoption of New Cereal Varieties in India"; "Cooperative Credit for Small Farmers in India"; "Some Dimensions of Small Farm Credit Problems in India"; "Small Farmer Credit Programs in India"; "Agricultural Credit in India and Pakistan—How Important was Credit for the Green Revolution"; "Bibliography on Agricultural Credit in India"; "Interim Report on

Credit Services for Small and Marginal Farmers and Agricultural Laborers" (India); "The Cooperative System of Small Farmer Credit in Sri Lanka."

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XI. SMALL FARMER CREDIT IN EAST ASIA

Agency for International Development. R. B. Morrow, D. W. Adams, Nguyen An Nhon, *et al.* February 1973. 475 pages.

PB–224 035

This Volume is comprised of nine separate papers discussing farm credit programs and practices in Indonesia, Korea, Malaysia, Taiwan, and Republic of Vietnam. The titles of these papers are as follows: "Farm Credit in Korea"; "Rural Capital Markets and Small Farmers in Taiwan, 1952-1972"; "The Rural Banking System in Vietnam with Credit for Small Farmers"; "Credit and the Small Farmer—Case Study of the Mekong Delta, South Vietnam"; "Short Term Padi Production Credit Scheme in the Muda Irrigation Project Area of Malaysia"; "Rural Credit in Indonesia—The BIMAS Program"; "The BIMAS Program for Self-sufficiency in Rice Production"; "Indonesia's Green Revolution—The Abandonment of a Non-market Strategy towards Change"; Episodes in Rural Modernization—Problems in the BIMAS Program."

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XII. SMALL FARMER CREDIT IN THAILAND

Agency for International Development. Marcus D. Ingle, and Alton F. Gamble. February 1973. 240 pages.

PB–224 036

This Volume is comprised of three separate papers discussing farm credit programs and practices in Thailand. The first of these "Bank for Agriculture and Agricultural Cooperatives (BAAC)", describes and evaluates the BAAC farmer loan program. BAAC is the major source of institutional agricultural credit in Thailand, and the government's primary instrument for expanding agricultural credit as a means for promoting agricultural development. The remaining two papers, "Amphur Farmer Groups—End of Tour Report" and "Amphur Farmer Groups—in Depth Report", describe, analyze, and evaluate a project which was initiated in an effort to introduce improvements in farming methods, credit facilities, production inputs, and marketing services in the economically depressed areas of North and Northeast Thailand.

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XIII. SMALL FARMER CREDIT IN THE PHILIPPINES

Agency for International Development. Orlando Sacay, and Kenneth F. Smith. February 1973. 114 pages.

PB–224 037

This Volume is comprised of four separate papers describing farm programs and practices in the Philippines. The paper "Small Farmer Credit in the Philippines" discusses the Philippine agricultural credit system; activities of the Development Bank of the Philippines, the Philippine National Bank, the Agricultural Credit Administration, commercial banks, rural banks, and small farmer credit institutions; availability of credit; inequities; and provides an annotated bibliography on the subject. "Credit and Small Farmer Development in the Philippines" attempts to identify the circumstances under which institutional credit becomes necessary in a Philippine setting. "Small Farmer Savings Behavior" reviews the available information on the subject, and describes experiences in generating cash savings in selected rural areas in the Philippines. In "Palay Productivity and Profitability in Iloilo 1971-72", an analysis is provided of the economic and technological factors bearing on the production of palay (paddy rice) in Iloilo Province, Panay Island.

A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XIV. SMALL FARMER CREDIT, HYV IN PAKISTAN

Agency for International Development. R. I. Rochin, M. K. Lowdermilk, and M. Naseem. February 1973. 448 pages.

PB–224 038

This Volume is comprised of four separate papers dealing with small farmer adoption of high-yield varieties (HYV) of cereal crops in Pakistan. The first paper, "A Micro-economic Analysis of Smallholder Response to High-yielding Varieties of Wheat in West Pakistan", a study of the adoption of HYV in the Hazara District, serves as an introduction to recent HYV experience in Pakistan. "Diffusion of Dwarf Wheat Production Technology in Pakistan's Punjab" analyzes factors explaining and constraining small farmer HYV adoption in the irrigated Multan District. "Field Survey of Small Farmers in Sahiwal District, Pakistan" and "Credit Availability and the Viability of Small Farms in the Pakistan Punjab" both derive from a single larger study of the role of small farmers in the agricultural transformation of Pakistan. The first of these provides economic data on the small farmers in a representative agricultural district; and the second introduces a programming model (and results obtained therefrom) which makes possible a systematic exploration of the effects on farm growth of initial farm size, the rate of interest, and alternative sets of domestic prices.

A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XV. SMALL FARMER CREDIT, INFORMAL CREDIT

Agency for International Development. C. T. Nisbet, R. A. J. Roberts, M. F. Long, *et al.* June 1973. 421 pages.

PB–224 039

This Volume is comprised of eleven separate papers dealing with informal credit systems serving small farmers in developing countries, as well as a few other private sector credit systems which are often excluded in surveys of institutional credit. The titles of the papers are as follows: "Informal Lenders as Suppliers of Development Credits to Small Farmers in Developing Countries —Attractive or Deceptive Alternative"; "Some Aspects of the Utilization of Existing Credit Sources by Institutions Applying Public Funds to Small Farmer Credit Programmes in Africa"; "Credit for Small Farmers—Indonesia, Malaysia, Thailand"; "A Study of Agricultural Tenancy in the Philippines"; "Zambia—Private Borrowing and Lending Arrangements Involving Cultivator's Cash Savings"; "Credit and the Small Farmer, Case Study of the Mekong Delta, South Vietnam"; "The Rotating Credit Association—'A Middle Ring' in Development"; "A Rotating Credit Association in the Dominican Republic"; "The Influence of 'Ke' Societies upon Ri-Dong Agricultural Cooperative Association" (Korea); "Credit Systems for Small-Scale Farmers—Case Histories from Mexico"; "Savings and Investment Among the Riobambenos del Rio Chilimpe" (Ecuador).

A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XVI. SMALL FARMER CREDIT, ADDITIONAL PAPERS

Agency for International Development. M. D. Whitaker, J. P. Ribeiro, J. Tindler, *et al.* June 1973. 332 pages.

PB–224 040

This Volume is comprised of eleven separate papers which, for one reason or another, could not be included in the other Volumes of this series. The titles of the papers are as follows: "Supervised Credit—Its Impact on Profits, Production, Factor Use, Technical Change, and Efficiency of Resource Allocation in Corn Production in Colombian Agriculture"; "The *ACAR* Program in Minas Gerais, Brazil"; "Institutional Success—*ACAR*"; "Agricultural Credit in Latin America—Persistent Problems and Potential

Promises"; "Are Small Farmer Credit Programs Getting at the Cause of Small Farmer Problems"; "A Three Story Agricultural Banking System"; "Agricultural Credit Policy in Developing Countries"; "The Interest Rate Policy for Agriculture in Developing Countries, the Prescription Versus the Experience"; "Agricultural Supervised Credit, the Farmer's Home Administration Way"; "Design Criteria Suggested by Mexican Experience"; "Cooperative Credit in Perspective—A Case Study of West Pakistan".

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XVII. SMALL FARMER CREDIT, COUNTRY SURVEYS

Agency for International Development. Jerome E. Sherry (Editor). June 1973. 244 pages.

PB–224 041

This Volume is comprised of excerpts from the introductory sections of papers from other Volumes in this series which deal with country programs in small farmer credit. The purpose of this compilation is to offer the reader a comprehensive view of various farmer credit programs around the world. The countries represented here are: Afghanistan, Bangladesh, Bolivia, Brazil, Chile, Colombia, Ecuador, El Salvador, Ethiopia, Ghana, Honduras, India, Indonesia, Iran, Jordan, Kenya, Korea, Malaysia, Morocco, Nicaragua, Nigeria, Pakistan, Peru, Philippines, Sri Lanka, Sudan, Taiwan, Thailand, Turkey, and Vietnam.

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XVIII. HISTORY OF A. I. D. PROGRAMS IN AGRICULTURAL CREDIT

Agency for International Development. E. B. Rice. June 1973. 177 pages.

PB–224 042

This Volume provides a descriptive history of the U.S. Agency for International Development's investments in agricultural credit since these programs began in the early 1950's. It is not restricted to credit for small farmers, although consideration is given to that component. Consideration is given to the basic charasteristics of the programs; the issues involved, such as institution building, production programs, supervised credit, and cooperative credit; and small farmer emphasis. A rather extensive appendix is comprised of individual summaries of program activities in each of the 42 countries involved.

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XIX. SMALL FARMER CREDIT, ANALYTICAL PAPERS

Agency for International Development. A. Gayoso, M. P. Miracle, C. B. Baker, *et al.* June 1973. 419 pages.

PB–224 043

This Volume is comprised of papers which largely base their analysis upon papers which appear in previous volumes in this series. The general subject matter covered includes: The role of small farmer credit; institutional alternatives for small farmer credit; and policy issues in small farmer credit. The titles of the individual papers are as follows: "A Typology of Small Farmer Credit Programs"; "Regional Similarities and Differences in Small Farmer Credit"; "Role of Credit in the Economic Development of Small Farm Agriculture"; "Conditions for Success of Public Credit Programs for Small Farmers"; "Technology, Profit, and Agricultural Credit"; "The Trouble with Goals of Small Farmer Credit Programs"; "The Credit Connection—Cultural and Social Factors Affecting Small Farmer Participation in Credit Programs"; "The Distribution of Agricultural Credit and Benefits—Political Economy and Small Farmers in Less Developed Countries"; "Institutions and Institutional Issues Associated with Small Farmer Credit in Development Countries"; "Notes on Developing Small Farmer Credit Institutions in Third World Countries"; "Analysis of Organizational Aspects of Small Farmer Credit Programs"; "Group Credit for Small Farmers"; "Co-ops Can Help if Governments are Willing"; "Cooperatives and Development Through Small Farmer Credit"; "The Case for Voluntary Savings Mobilization—Why Rural Capital Markets Flounder"; "Interest Rate Policies and Small Farmer Credit Programs in LDCs"; "Higher Interest Rates Reconsidered"; "Rationalizations and Operating Procedures for Small Farmer Credit Programs"; Subsidized Small Farmer Credit—The Graduation Problem"; "The Need for Flexibility in Small Farmer Credit Programs."

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A. I. D. SPRING REVIEW OF SMALL FARMER CREDIT. VOLUME XX. SMALL FARMER CREDIT, SUMMARY PAPERS

Agency for International Development. E. B. Rice, A. Bottomley, C. H. Gotsch, J. W. Mellor, and G. Donald. June 1973. 108 pages.

PB–224 044

This Volume is comprised of three separate sections which serve to summarize a series of field workshops on farm credit which were held in the period March through May 1973. The first section, "Summary of the Spring Review of Small Farmer Credit", reviews the analytical papers presented in Volume XIX of this series. Next, three eminent agricultural economists offer their criticism and commentary on the aforesaid analytical papers. Finally, "Lessons from the Workshops" provides a restatement of the principal findings of the Spring Review Workshops, and gives a documentary review of their activities.

AN ECONOCOLOGICAL ANALYSIS OF SMALL FARM MODERNIZATION: ADJUSTMENTS TO MECHANIZATION IN UPPER VOLTA

University of Tennessee. Thomas L. Vollrath. March 1973. 109 pages.

PB–224 181

Ninety-five percent of the working population of Upper Volta secure their livelihood from farming. Yet the physical environment is severe and not endowed with features favorable to agriculture. Consideration is given in this document to ways in which the people in one region of Upper Volta might improve their level of living. A survey is provided of the tillage problems confronting the farmer cultivator in the cercles (states) of Koupela, Tenkodogo, and Garango. A conceptual framework is then presented which is designed from change agents to use in identifying key elements of the society that affect the adoption of modern technology. Finally, the meanings of the various elements outlined in the framework are elaborated, upon and the framework is related to problems associated with the modernization issue.

INVESTMENTS IN NIGERIA'S NORTHERN CATTLE INDUSTRY: A SIMULATION ANALYSIS

Michigan State University. Earl D. Kellogg. 1972. 80 pages.

PB–224 182

As a developing country advances in economic status and industrial accomplishment, periodic assessment is of value to outside investors and suppliers of technical assistance. The report deals with the cattle industry in Northern Nigeria. It presents and discusses a tool for analyzing policy experiments, consisting of a set of computer models of cattle production and distribution. The production sector has been modeled using systems simulation techniques; the distribution sector uses linear and quadratic mathematical programming. The focus is on experimental results, detailed development of the models being presented in references cited in the included bibliography. The experiments were conducted on the computer models to investigate the likely consequences through time of alternative investment programs from 1971 to 1995. Nigeria in 1953 is used as the base. Some of the

Agricultural Economics (continued)

factors involved are tsetse fly clearing, price-import policy, grazing reserves, tax and sales tax revenues, cattle transportation costs, transport facilities through time, and fly eradication investments. Summaries are made of production model results and transportation model results.

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Agricultural Technology

SOIL AND WATER MANAGEMENT FOR SALINITY CONTROL

New Mexico Water Resources Research Institute. P. J. Wierenga, G. A. O'Connor, and H. E. Dregne. December 1972. 64 pages.

PB–214 560

The conventional method for reducing soil salinity in irrigated areas is to leach the soil by applying more water than is actually needed for crop production. This method is not only costly and wasteful of water but also represents a source of ground and surface water pollution; accordingly, alternate techniques are needed. Recent investigations have indicated that smaller applications of water can increase salinity control with the advantage of reducing pollution problems. Since soils require some time for the effects of changes in irrigation management to become measurable, mathematical models are desired by which the effects of management on salinity levels can be determined, and the transfer of times of nitrates, phosphates, and pesticides to the water table can be predicted. The report covers the construction of a model to determine water and salt movement under unsaturated soil water conditions. In addition to computer models for predicting the simultaneous movement of salts, water, and pesticides, considerable data are given on the movement of salts and pesticides through soil columns, providing needed information on ion behavior in a soil profile and helpful in the testing of future models on salt movement in a calcarious soil.

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TAILORING OF FERTILIZERS FOR RICE

Tennessee Valley Authority, Soils and Fertilizer Research Branch. O. P. Engelstad, and V. J. Kilmer. 1970. 118 pages.

PB–215 793

Substantial losses of fertilizer nitrogen from flooded rice soils may occur even under conditions of good water management. If water management is poor as is often the case nitrogen losses will be severe. A report is made on progress in a fertilizer program for rice in selected developing countries. Among the field experiments discussed are investigations of various nitrogen and/or phosphorus materials for flooded rice, new fertilizer coatings to increase the efficiency of nitrogen in flooded soils, and tests of hypotheses relating to the fate of nutrients in flooded systems, especially coatings which release nutrients gradually over the growing season. Data are given on sulfur-coated urea materials sent to India, the Philippines, and Colombia, and on United States rock phosphates shipped to Colombia, the Philippines, India, Ceylon, Thailand, and Indonesia. Greenhouse pot experiments with flooded rice are noted. Triggering agents are described, such as ferric hydroxy acetate, ferric phosphate, hydrated ferric oxide, and ferris ammonium pyrophosphate.

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EFFECT OF SETTLEMENT OF FLUME RATINGS

Colorado State University, Agricultural Engineering Department. Tsu-Yang Wu. August 1971. 99 pages.

PB–223 944

Water measuring devices are important to irrigation systems in order to foster good management, meet legal needs, conserve water, and insure equitable distribution. Growth of population and urban-industrial-agricultural demand makes optimum use of water even more important. Of several types of open channel measuring devices, the flume has been popular because of its endurance, initial accuracy, and lack of silting. However, horizontal orientation of an unlined flume can be impaired by the scouring action of high velocity outflow. The resulting settling affects discharge rating and requires correction. The report is directed to the amount of this correction as influenced by increase of tilt angle and length of the flume. Laboratory flow test results are provided for four cutthroat flumes—modified venturi configurations with a horizontal floor, entrance section, exit section, and no throat length. Hydraulic data are discussed under both free flow and submerged flow conditions for each of the flumes for various degrees of flume floor slope.

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PROCEEDINGS OF THE TENTH RARE EARTH RESEARCH CONFERENCE

U.S. Atomic Energy Commission, Technical Information Center. Clement J. Kevane, and Therald Moeller (Editors). 1973. 1,229 pages (2 volume set).

CONF–730402

These volumes are comprised of preprints of papers which were read at a conference held in April and May 1973. Approximately 140 papers are included, of which about one-third are by workers from outside the U.S. The subject matter is highly interdisciplinary in nature, and includes topics drawn from the fields of bio-inorganic chemistry, magnetics, metallurgy, nuclear magnetic shift reagents, solid state science, lanthanide-actinide chemistry, industrial technology, and spectroscopy.

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PROFIT OPPORTUNITIES FOR THE CHEMICAL PROCESS INDUSTRIES

Battelle Columbus Laboratories. November 1971. 93 pages.

N73-14937

A seminar was held in November 1971 as part of efforts of the National Aeronautics and Space Administration (NASA) to assist industry in the utilization of NASA-developed technical innovations. The program was arranged primarily for representatives of the chemical industry. Some of the topics included were chosen to demonstrate the process by which some developments were already being commercialized. In addition others were selected to suggest some areas of technological development in which there are NASA-sponsored developments which could be of great value to the chemical industry. This document is comprised of the papers prepared for the seminar. Some of the specific subjects covered include: NASA patent licensing policy; case history of the successful transfer of HYSTL resins; nonflammable cellulosic materials development; commercialization of nonflammable paper technology; improved circuit board laminates; profit opportunities for improved polyimide resins; intumescent coatings.

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SURVEY OF APPLICATION OF RADIATION TO PREPARATIVE CHEMISTRY

Lewis Research Center (NASA). Warren H. Philipp. May 1973. 33 pages.

N73–24156

The use of radiation methods in preparative chemistry has the advantage that extremely reactive radicals can be produced at low temperatures without the addition of reagents that would contribute to product impurity. Moreover, preparations involving radiation can be conveniently carried out at room temperature or below to minimize contamination of the product by the environment (e. g., by diffusion of container material) as well as to diminish decomposition of thermally unstable compounds. This report outlines in part the scope of radiation preparative chemistry as seen today, presents the principles involved and, where appropriate, cites examples of preparations. The report limits its field of consideration to liquid solutions and is arranged according to the solvent employed: aqueous solutions, other inorganic solvents, polar and nonpolar type organic liquids. The categories of reactions discussed include reductions, oxidations, polymerizations, decompositions, and free-radical reactions.

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CONVERSION OF ILMENITE TO RUTILE BY A CARBONYL PROCESS

Bureau of Mines, Rolla Metallurgy Research Center. A. Visnapuu, B. C. Marek, and J. W. Jensen. 1973. 24 pages.

PB–214 780

Rutile is the preferred material for the production of pigment-grade titanium dioxide, welding-rod coatings, and titanium metal. Various economic reasons have led to a number of proposals for the production of synthetic rutile from ilmenite. This report describes a new carbonyl process by which high-grade synthetic rutile has been produced in the laboratory from ilmenite concentrates. Basically, the process involves the reaction of carbon monoxide with reduced ilmenite to form volatile iron pentacarbonyl, leaving titanium dioxide as a residue. The iron pentacarbonyl can be decomposed to high-purity iron powder and carbon monoxide. The latter can be recycled in the process. The product rutile is porous and suitable for chlorination.

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COMMUNICATIONS

TELECOMMUNICATIONS RESEARCH IN THE UNITED STATES AND SELECTED FOREIGN COUNTRIES. VOLUME I, SUMMARY. VOLUME II, INDIVIDUAL CONTRIBUTIONS

National Academy of Engineering, Panel on Telecommunications Research. June 1973. 285 pages.

PB–222 080–SET

This report provides the results of a preliminary survey of the status and trends of telecommunications research in the United States and in other technologically advanced countries. Volume I summarizes the contents of Volume II and, in addition, provides two specialized reports. These deal with telecommunications research outside of the United States, and a review of the status and trends of telecommunications research by functional areas. Some of the specific topics covered by Volume II include: Analytical approach to the study of telecommunications research; interdisciplinary research and development problems in telecommunications; research on spectrum propagation and related topics; the effect of standards on research and development in telecommunications; biomedical and sociological implications of telecommunications research; interface man-computer data entry; interactive cable television systems; training and education of professional telecommunications engineers; computer terminals; future use of communications and terminals in education; optical communications; research trends for communication satellites; earth stations; computer communication networks; research directions in networks of computers; research in telecommunications switching; research on the command and control of rail transportation; microprogramming; speech analysis and synthesis. (These Volumes are also available separately; Volume I as PB-222 081, and Volume II as PB-222 082.)

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TECHNICAL ECONOMIC CONSIDERATIONS IN PUBLIC SERVICE BROADCAST COMMUNICATIONS FOR DEVELOPING COUNTRIES

Academy for Educational Development; and Massachusetts Institute of Technology. Robert C. Butman, George W. Rathjens, and Colin J. Warren. 1973. 330 pages.

PB–223 266

This report represents the culmination of an inquiry into the distribution of educational material in developing countries with attention to the problems and opportunities in Brazil and India particularly. The emphasis in the report on the use of television and of satellites to distribute T.V. programming is in part a reflection of the great interest in the use of satellite-T.V. systems in those two countries: in the former, primarily for in-school education of children; and in the latter, for adult education with respect to such matters as family planning and improved agricultural practices. The report consists of five parts: an introduction to the problems of communications for education in developing countries, including some caveats about the limitations of the study and a discussion of the problems of system choice and costs; an analysis of the possibility of satellite television for India, including a comparison with distribution by microwave relay; a discussion of telecommunications and education in Brazil; a commentary on expanding radio and T.V. services in Ethiopia; and a compendium of technologies relevant to communications for education.

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COMPUTERS AND INFORMATION SCIENCES

INFORMATION AND ITS RETRIEVAL

U. S. Army Aberdeen Research and Development Center. Ceslovas Masaitis. November 1970. 57 pages.

AD–718 032

This report discusses problems in the field of information storage and retrieval. It is felt that some aspects of these problems are considered that are not a mere repetition or reformulation of ideas discussed elsewhere. First of all, a clear distinction is made between documents and information, and consideration is given to the problem of storage and retrieval of the latter. Secondly, it is proposed that information systems should be constructed by professionals. This is just the opposite of an attempt to mechanize the classification of documents. Thirdly, the discussion centers on the functions that should be performed by a retrieval system, rather on technical devices that can be used to record and recover information.

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INFORMATION SCIENCES: DATA AND INFORMATION HANDLING, STORING, RETRIEVING AND DISSEMINATION. VOLUME I.

Defense Documentation Center. March 1972. 274 pages.

AD–739 600

INFORMATION SCIENCES: INFORMATION CENTERS AND SPECIAL LIBRARIES. VOLUME II.

Defense Documentation Center. March 1972. 159 pages.

AD–739 610

INFORMATION SCIENCES: INFORMATION PROCESSING SYSTEMS AND TECHNIQUES. VOLUME III.

Defense Documentation Center. March 1972. 309 pages.

AD–739 620

INFORMATION SCIENCES: CONFERENCES, SYMPOSIA, REVIEWS, SUPPORTING RESEARCH AND STINFO ACTIVITIES. VOLUME IV.

Defense Documentation Center. March 1972. 232 pages.

AD–739 630

These bibliographies are comprised of abstracts of reports of research, funded by the U.S. Government, on various aspects of information sciences. The time period covered is January 1953 through January 1972. Subject, corporate author, personal author, and title indexes are included. Most of the reports listed in the bibliographies are available from NTIS.

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GEOMETRIC CONCEPTS FOR COMPUTER GRAPHICS

United States Naval Academy. J. Alan Adams. August 1972. 236 pages.

AD–750 743

This document provides an elementary presentation of some mathematical techniques that can be used to generate, manipulate, and display graphical information such as points, lines, and curves by use of a digital computer. A sufficient prerequisite is a knowledge of linear algebra and calculus. The material should be useful to professional people and students who come into contact with computer graphics. It also serves as a useful introduction to more advanced topics in computational geometry and surface description.

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A BIBLIOGRAPHY OF STAFFING CRITERIA FOR LIBRARIES, INFORMATION CENTERS, AND INFORMATION ANALYSIS CENTERS

George Washington University. Caroline Stanley, and Mildred Benton. August 1970. 37 pages.

AD–752 137

This annotated bibliography of 159 references identifies the staffing and organizational problems of libraries and information science centers. The majority of the titles listed have been published since 1963. Facets explored involve the mission, functions, and operations of facilities, the classification of positions in these facilities including duties and responsibilities, and budget allocations, all of these being related to staffing. Particular attention is paid to material which provides criteria. Some of the topics are the characteristics of analysis centers as differing from document centers, standards at the state level, personnel organization and training, library service costs, management policies, audio-visual materials, systems analysis, professional duties, automation and computed aided operations, specialized information, library technology, state-of-the-art review of the library role, evaluation and planning, and university facilities.

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Computers and Information Sciences (continued)

COMPUTERS IN INFORMATION SCIENCES (COMPUTER PROCESSING OF ANALOG DATA)

Defense Documentation Center. March 1973. 191 pages.

AD–757 500

The bibliography contains abstracts of reports of U.S. Government-funded studies that dealt specifically with the role of computer processing of analog data. General subjects are analog data and computers, information retrieval and sciences, digital computers and data, analog-digital computers and converters, and on line systems. Specific topics include input-output devices, information systems, medical equipment, telecommunication, delay lines, aircraft and aerospace, statistical analysis, physiological research, cybernetics, automation, mathematical logic and models, display systems, fluid mechanics, industrial engineering, meteorology, decision making, computer technology, chemical engineering, mechanical engineering, and underwater sound. (The reports listed in this bibliography are available from NTIS. Prices will be supplied on request.)

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GOVERNMENT ASSISTANCE FOR TECHNICAL INFORMATION IN INDUSTRY AND SIMPLE MECHANIZATION FOR SMALL INFORMATION CENTERS

North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Development. March 1973. 99 pages.

AD–759 845

This document is comprised of papers presented at the 25th Meeting of the AGARD Technical Information Panel, which was held at Ankara, Turkey in October 1972. The papers deal with how small information centers should be established and developed, and what forms of assistance from government should be looked for. The specific topics covered include: The present state of information activities in Turkey and future trends; establishing small information centers in industry; training of personnel to man the various parts of an information center and to operate various kinds of service; present economics and future use of microforms; problems of data recording and data interchange; presenting an information facility development plan for approval; information services for industry utilizing taylored abstracts and technical digests; information extension services for industry; development and use of a modern data bank.

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COMPUTERS IN INFORMATION SCIENCES: COMPUTER COMPONENTS

Defense Documentation Center. June 1973. 354 pages.

AD–761 970

This bibliography is comprised of abstracts of reports resulting from U.S. Government funded research on computer technology utilized in information systems and retrieval. General subjects covered are computer memory devices, data storage systems, arithmetic and logic units, and punched card equipment. Some of the specific topics included are magnetic recording systems, magnetic core storage, computer maintenance, algorithms, digital and analog computers, input-output devices, multiple operation, programming and program control, machine memory, delay lines, air and space borne equipment, logic systems, simulation, mathematical models, symposia, networks and circuits, converters, data management, film devices, formatted files, information processing, man-machine systems; applications to engineering, medicine, and record keeping; and analysis of particular hardware. Subject, title, and author indexes are included. The reports listed are available from NTIS (prices on request).

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MANAGEMENT AND DESIGN TOOLS FOR DOCUMENT RETRIEVAL SYSTEMS: A METHOD FOR PREDICTING QUANTITY OUTPUT

Rand Corporation. Marco R. Fiorello. March 1973. 220 pages.

AD–763 623

The existing volume and increasing growth of documented information has resulted in numerous efforts to construct operational document storage and retrieval systems, as a practical solution to the demand for information storage and retrieval. There are, however, few effective tools for the designers and managers of document retrieval systems. The tasks of design and management of these systems require tools and performance measures to aid in the selection of preferred options, and in the control over the fundamental processes of inquiry analysis, indexing, retrieval, and system growth. A step toward the generation of operational tools to aid in the design and management tasks is presented in this document, by the development of a retrieval quality estimate. The retrieval quality estimate is defined as a function of the form of inquiry, search strategy and descriptor-document distribution, and can be used to predict the quantity output of an inquiry, measure the impact on quantity output due to system growth, and aid in the tuning of the indexing and formal inquiry specification processes. The retrieval quality estimate has been tested on an operational document retrieval system, and it has demonstrated high prediction accuracy for a variety of typical inquiries.

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ECONOMICS OF DEVELOPMENT

ECONOMIC POLICYMAKING WITH LITTLE INFORMATION AND FEW INSTRUMENTS: THE PROCESS OF MACRO-CONTROL IN MEXICO

Rand Corporation. John E. Koehler. January 1972. 72 pages.

AD–741 597

Construction of an economic model for a developing country, by which decision making is related to economic growth, can be an informative means of determining the effectiveness of economic policies. If, however, in a country such as Mexico where economic stabilization has been impressive but information has been poor and policy instruments appear scarce, construction of the model is difficult and an economic analysis must proceed along other lines. The report considers economic policy in Mexico with regard to the following questions: What information has been available to the policymakers? What instruments do they actually manipulate? What is the relation between this information, the instruments manipulated, and the state of the economy? A discussion of economic stability includes financial management by private investment rather than by public expenditure, governmental judgment during each six-year presidential term, resulting in a six-year political-economic cycle of governmental expenditures, and behavior of the banking system. The model also includes the relation of exports to imports and balance of payments considerations.

SOME RECOMMENDATIONS AFFECTING THE PROSPECTIVE ROLE OF VIETNAMESE HIGHLANDERS IN ECONOMIC DEVELOPMENT

Rand Corporation. Gerald C. Hickey. September 1971. 71 pages.

AD–742 404

Since the mountain areas that dominate several of the main routes of access into Vietnam are of strategic importance, the peoples who inhabit these mountains—the Vietnamese Highlanders—are consequently important. Some recommendations are made as to ways and means of bettering the lot of these highlanders and of drawing them more closely into the economic, social, and political structure of their country. A variety of standard anthropological techniques were used in gathering demographic data in towns, villages, farms, and fields. Traditional and innovative operations are noted, along with some discussion of the socioeconomic levels of the people themselves. The recommendations may be regarded as informed insight based on previous years of research familiarity rather than as an in depth analysis of problems.

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A. I. D. ECONOMIC DATA BOOK FOR AFRICA

Agency for International Development, Office of Statistics and Reports. July 1971. 373 pages.

PB–201 587

A. I. D. ECONOMIC DATA BOOK FOR EAST ASIA

Agency for International Development, Office of Statistics and Reports. July 1971. 181 pages.

PB–201 588

A. I. D. ECONOMIC DATA BOOK FOR LATIN AMERICA

Agency for International Development, Office of Statistics and Reports. July 1971. 328 pages.

PB–201 589

A. I. D. ECONOMIC DATA BOOK FOR NEAR EAST AND SOUTH ASIA

Agency for International Development, Office of Statistics and Reports. July 1971. 244 pages.

PB–201 590

These data books are comprised of narrative and statistical materials, on both a regional and country-by-country basis, concerning basic economic, demographic, and social indicators and trends. The regional sections cover such areas as population, national product, production, consumer price indexes, trade and investment, gross gold and foreign exchange holdings, student enrollment and teacher staff, external public debt, and loans and grants from abroad. Information provided for individual countries includes a summary economic background, summary of basic economic data, selected annual economic trends, economic indicators, central government finances, and balance of payments.

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CAPITAL-LABOR RATIOS, CAPITAL-OUTPUT RATIOS, AND RATES OF PROFIT IN INDIAN INDUSTRY

Cornell University, Department of Agricultural Economics. Grace Horowitz. February 1971. 18 pages.

PB–215 748

Appraisal of the economic potential of a developing country may be hampered by gaps in the available data, thereby making necessary some use of mathematical formulation. In a nation such as India, for example, where there are no price indices for land and buildings valid for the country as a whole, fixed capital information will include calculated replacement values for plant and machinery components. The paper presents capital-labor ratios, capital-output ratios, and rates of profits in India using four categories of capital: fixed; plant and machinery; fixed and working capital; and replacement value. Mathematical models are derived for these categories, and tabulated data are presented in exemplification. A few recommendations are made to improve the method, such as book value, employment data, and depreciation information as possible additions.

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THE ROLE OF SUPPLIERS' CREDITS IN THE INDUSTRIALIZATION OF GHANA, NIGERIA, AND SIERRA LEONE

Tufts University, International Development Studies Program. Leslie E. Grayson. October 1970. 49 pages.

PB–215 777

Suppliers' credits may be defined as the credit financing of private organization projects to supply governmental industrial programs, particularly in a developing country. The report examines the hypothesis that in financing Ghana's industrialization in the early 1960's there were considerable net costs of a type that could lead to questions of management. For example, in one type of arrangement, a foreign peddler may sell equipment to a private supplier of the buying country's government, obtaining credit from his foreign private bank and guaranteeing the credit by his own government. Thereupon the developing country must deal with the exporting country's credit organization, not the peddler. The interest cost to Ghana, as a result might increase from the 5.5% original to an actual rate of 9%. The amount of a nation's borrowing should involve the amounts already owed, but heavy borrowing by Ghana was proceeding when the value of her exports was decreasing, the level of foreign exchange reserves was falling, and the balance of payments deficits were persistent. Much attention is devoted in the reports to an analysis of such factors, conclusions are drawn, and indications are made for the future. Some information is given on other nations as well.

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INDICATORS OF PROTECTION AND OTHER INCENTIVE MEASURES

Harvard University, Center for International Affairs. Bela Balassa, and Daniel M. Schydlowsky. October 1971. 37 pages.

PB–215 789

This document presents and discusses a variety of analytical tools used in the analysis of trade policy and other public policy constituting incentive to economic activity. In particular, consideration is given to deriving indicators of trade protection and other incentive measures in Latin American countries. Methods of estimation by computers are described, and some of the major results derived thus far by these methods are discussed. Also, possible future developments in using simulation models and in evolving "policy packages" for the developing countries are examined.

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ECONOMIC GROWTH, STRUCTURAL CHANGE, AND THE RELATIONSHIPS AMONG NATIONS

Harvard University, Center for International Affairs. C. Gotsch. August 1970. 32 pages.

PB–215 792

The extent to which the domestic policies of capitalist societies dictate their international relations is discussed as a force toward imperialism abroad, particularly where internal economic structural changes create pressure for protection on one hand and goods dumping on the other. The mechanism leading to imperialism is concerned with the efforts of economic growth on resource allocation. The argument put forward in the report is that three processes are involved: (1) Unplanned economic growth in capitalist countries produces severe regional and sectoral distribution problems. (2) The nature of the social and political institutions in these countries creates difficulty in internal dealing with these issues. (3) Such societies have a tendency to resolve difficulties by spilling them over into the world economy, thereby solving a problem at the expense of others, usually the poorer countries. Thus the less developed countries in Southeast Asia, affected by a simultaneous increase in exportable surpluses, rural unemployment, and urban congestion call for considerable economic analysis and programming.

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ESTIMATES OF LABOR AGGREGATION FUNCTIONS

Harvard University, Center for International Affairs. C. R. S. Dougherty. March 1971. 54 pages.

PB–215 794

Sophistication of production theory has created some dissatisfacion with the treatment of labor as a homogeneous input, resulting n attempts to disaggregate it. At the same time educational planning has fostered research to improve understanding of the interactions of education, productivity, and labor force structure. The eport presents the concept of aggregation functions, or aggregate production functions. A mathematical model is derived using both cross-section and time-series data to estimate these functions for labor. Two separate classifications of labor are used for defining categories, one by occupation, the other by educational level. The elasticities of substitution are estimated for both classifications for the states of the United States. It would appear that a time-dependent constant elasticity of substitution function with a fine classification of labor should yield the most accurate predictions, providing the shift parameters are properly estimated. The report holds that the manpower requirements should be abandoned, to be replaced by rate of return analysis with constant relative wage rates, implying an infinite elasticity of substitution as a better tool for planning.

INVESTMENT PROJECT ANALYSIS IN A MODEL OF OPTIMAL GROWTH: THE CASE OF CHILE

Harvard University, Center for International Affairs. Lance Taylor. May 1971. 65 pages.

PB–215 797

The report introduces two recent theories about constraints on the growth of developing countries. One stresses institutional barriers to transforming surplus agricultural labor into an urbanized industrial work force, leading to the valuation of this new labor at a shadow wage below the market wage. The other, which forms the basis of the report, is the two-gap thesis that additional foreign exchange has a dual effect on the economy. It supplements domestic savings but builds a dependence on imports that results in a handicap termed external strangulation. Chile is a nation which depends on foreign trade, particularly imported capital goods. The paper describes a set of numerical experiments with a small optimal growth model, aimed at calculating a set of shadow prices for evaluation of investment projects in the Chilean economy. The numerical results involve a rate of discount consistent with the results of other rate-of-return studies in the nation, a very flat transformation surface between the traded and non-traded sectors with a correspondingly inflexible relative price ratio, and an inverse proportionality between tariffs and the exchange rate. The model determines allocation of factors between two sectors or variables—one standing for plant-type capital goods produced by a non-traded sector, and the other representing equipment-type capital goods which must be imported. These imports are paid for by exogenous traditional exports and exports from a traded goods sector. The effect on investment projects is discussed.

A GUIDE TO INSTRUCTIONAL USES OF MICROFORM

Denver Research Institute. James P. Kottenstette, Alta Bradley Morrison, Anita S. West, and Robert R. Grausnick. May 1971. 80 pages.

AD–734 741

A modern and highly useful means of information storage and retrieval is the microform, in which data are recorded in a size too small to be read by the unaided eye. Opaques are microforms which will not transmit light, printed on paper tapes or cards in a reduction from a fifth to a twentieth of the original type size. Transparencies are see-through materials, mainly roll or flat films of various sizes, occurring as strip films on a spool or reel and designated as microfilms, or as single films or microfiche stored separately or in sheets of images. The guide presents information on the use of microforms in a training environment, giving basic background on these materials as a communications medium and illustrating the steps required in their use. A review is made for instructional purposes, including definitions of terms, materials, and concepts, techniques and processes, costs, and sources; capabilities for training; and a plan for teaching. Reading machines for microforms are given some attention.

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ASIAN INSTITUTE OF TECHNOLOGY

Office of Naval Research. Lambert Tall. January 1972. 35 pages.

AD–737 612

The Asian Institute of Technology, Bangkok, Thailand, is probably the best known institute of higher learning in Southeast Asia. It is an excellent example of the initiation and organization of a technical university. This report reviews the manner in which its success was accomplished and the details of its operation. Consideration is given to the organization and facilities of AIT; faculty, staff, and students; curriculum and degrees; research.

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HANDBOOK OF SMALL-GROUP METHODS OF INSTRUCTION

Human Resources Research Organization. Joseph A. Olmstead. May 1972. 71 pages.

AD–741 829

The purpose of this handbook is to provide practical guidance for the selection and use of some of the more common small-group (fewer than 20 students) methods of instruction. It is designed to assist trainers and training managers to identify methods that will best accomplish desired instructional objectives or, given a method, to determine the objectives that it will accomplish and its requirements in terms of time, instructors, students, facilities, etc. The emphasis is on methods and procedures, rather than on rationale and theory. Various methods, case discussions, and problem-solving and role-playing exercises are included.

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PROGRAM COST ANALYSIS IN EDUCATIONAL PLANNING

Rand Corporation. Sue A. Haggart. December 1971. 41 pages.

AD–742 403

Any consideration of prospective educational programs will require an examination of their anticipated costs as well as expected student performance. The report deals with conceptual and methodological bases of cost analysis, and develops a planning cost model for estimating program costs. Rather than the usual practice of basing the analysis on cost per student, without any indication of what is included, the model covers alternative programs. Such analysis includes the facilities, staff, equipment, materials, and services needed to conduct alternative educational programs, and translates these resource requirements into an estimated program cost. The program itself must first be defined, following which the resources are determined. The model is described in terms of cost categories based on students, programs, units, or services. Illustrative outlines are included.

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TRAINING EVALUATION AND STUDENT ACHIEVEMENT MEASUREMENT: A REVIEW OF THE LITERATURE

Applied Psychological Services, Inc. Brian A. Bergman, and Arthur I. Siegel. January 1972. 57 pages.

AD–747 040

Any examination of alternative educational programs must be concerned with both effectiveness and cost. Since student performance is one of the measures of program effectiveness, major attention has been paid to educational outcome, while determining educational program costs has received less attention. The report explores the conceptual and methodological basis of cost analysis, and develops a planning cost model for alternative programs. For a number of cost categories there are estimates of cost on either a student, program, unit, or service basis. Such factors as staffing, equipment, materials, training time, services, and support are discussed. Resource requirements are also noted. These and allied considerations are documented from a review of the literature for the 20-year period prior to 1970.

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TELEVISION EDUCATIVA VIA SATELITE. ESTUDIOS DE ANTECEDENTES Y PROYECTO PRELIMINAR DE PLAN. TOMO I.

Comision Nacional de Investigaciones Espaciales (Argentina). 1970. 85 pages. Text in SPANISH.

N72–18151

TELEVISION EDUCATIVA VIA SATELITE. ESTUDIOS DE ANTECEDENTES Y PROYECTO PRELIMINAR DE PLAN. TOMO II.

Comision Nacional de Investigaciones Espaciales (Argentina). 1970. 85 pages. Text in SPANISH.

N72–18152

The first Tomo of this study provides a general review of the use of educational television via artificial earth satellite. The problems associated with such systems are discussed, as well as the advantages and disadvantages of various types of systems. Previous research and projects involving educational satellite television are considered. Tomo II concerns a preliminary design for a national and regional education system, using satellite television, for Argentina and other South American countries. International aspects of educational TV and legal precedents are considered. Population distribution and educational statistics are also presented.

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A GUIDE TO THE LITERATURE ON APPLICATION OF COMMUNICATION SATELLITES TO EDUCATIONAL DEVELOPMENT

Washington University. Robert P. Morgan, and Jai P. Singh. February 1972. 41 pages.

N72–21968

Communication satellites are one of the communication technologies which are capable of transmitting and distributing electronic information (radio, television, digital computer data) for use in education. Because of the ability of satellites to deliver signals over wide areas with potentially attractive costs, considerable interest has been shown in using satellite technology to enhance educational programs. Major planning efforts for utilization are underway in Brazil, India, French-speaking Africa and other areas. This literature guide provides an introduction to three related subjects: (1) satellite technology; (2) nontechnical aspects, including economic, organizational, social, political, and legal factors; and (3) educational and developmental uses of satellites, including experiments and systems planned or proposed. Also included is a basic "reference shelf", which will provide the reader with a broad overview and good starting point for a more detailed literature investigation, and a guide to organizations with interest in educational satellite utilization. Finally, a fairly extensive bibliography on the subject is given.

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PRIMER ON TELECOMMUNICATIONS IN EDUCATION

Synergetics Incorporated. Carl Pilnick and Harry R. Glixon. March 1972. 401 pages.

PB–214 613

This survey report is intended to serve as a primer or general reference handbook for the educator and the educational administrator concerned with applying telecommunication technology to the process of education. As generally defined, telecommunication involves the use of electronic/electrical/electromagnetic technology to transfer information over distance, between a source and a place of reception. The report considers telecommunication in education as providing remote information transfer, and is intended to serve as a handbook on components and techniques, including the fundamentals of audio, video, hard copy, and computers; carrier and distribution subsystems such as wire carriers, broadband communications networks (CATV), instructional television fixed service, and communication satellites; integrated education systems, including operational audio, audio-visual; and computer-based facilities; and an evaluation of trends, leading to a forecast of future applications. Fundamental terms and concepts are defined. Audio includes microphones and speakers, audio storage and playback, modulation, and multiplex; video includes camers and scanners, conversion TV receivers and CRT displays, video tape, and home recorders; hard copy includes alphanumeric terminals, teletype and teleprinters, facsimile, and photographic conversion; and computers include operation, software, computer aided instruction, and information storage and retrieval. Telephone systems are also discussed.

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INDIAN EDUCATIONAL MATERIAL. VOLUME 6 NUMBER 1

U.S. Department of Health, Education and Welfare, Office of Education; and Indian National Scientific Documentation Centre. A. Joseph (Editor). March 1971. 96 pages..

TT–70–53082/1

INDIAN EDUCATIONAL MATERIAL. VOLUME 6 NUMBER 2

U.S. Department of Health, Education and Welfare, Office of Education; and Indian National Scientific Documentation Centre. A. Joseph (Editor). June 1971. 96 pages.

TT–70–53082/2

INDIAN EDUCATIONAL MATERIAL. VOLUME 6 NUMBER 3

U.S. Department of Health, Education and Welfare, Office of Education; and Indian National Scientific Documentation Centre. A. Joseph (Editor). September 1971. 89 pages.

TT–70–53082/3

INDIAN EDUCATIONAL MATERIAL. VOLUME 6 NUMBER 4

U.S. Department of Health, Education and Welfare, Office of Education; and Indian National Scientific Documentation Centre. A. Joseph (Editor). December 1971. 92 pages.

TT–70–53082/4

These publications are comprised of abstracts of books, reports, and articles which were published in India and which concern education in India. The subject matter covered includes the following: Academic achievement; administration and organization; adult education; "brain drain"; courses of study; curriculum; general education; educational psychology; educational research; education sociology; examination and evaluation; guidance and counselling; higher education; instructional material and aids; policy and planning; pre-primary education; primary education; reading; school forms; science education; secondary education; social education; special education; student indiscipline; student union; teachers and teacher education; teaching methods; tests and measurements; vocational and technical education; woman's education; worker's education. In addition, a special section on education for national integration is contained in No. 1; on student participation in educational administration in No. 2; and on basic education in No's. 3 and 4. All abstracts are in English.

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ENERGY

GEOTHERMAL ENERGY

Los Alamos Scientific Laboratories. Morton C. Smith. May 1973. 33 pages.

LA–5289 MS

The report presents an introduction to geothermal energy and discusses its present and projected uses in terms of economics, current technology, and environmental impact. Both the advantages and disadvantages of geothermal energy and its conversion to electricity are considered. Among the observations are the following: All but a thin crust of the earth at its outermost surface is very hot, as evidenced by lava flows, hot springs, geysers, and fumaroles, and this heat if utilized could supply most of mankind's needs for energy, particularly clean energy. No demonstrated system yet exists for extracting this energy, but the reservoir is so vast, broadly distributed, and in many places accessible that it is being given the serious technical attention the approaching energy crisis demands. There are mysteries about wet geothermal reservoirs which produce hot springs, geysers, and fumaroles that deserve study. During the next ten years there should be significant improvements in techniques of prospecting for immediately usable geothermal reservoirs, and development of improved drilling equipment, and the devising of totally new drilling systems. Nonelectrical uses of the heat from natural hot water will increase in such applications as domestic and industrial heating and air conditioning, desalination of water, distillation of domestic and industrial wastes, recovery of minerals, and physical and chemical processing.

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ENERGY EXPENDITURES ASSOCIATED WITH THE PRODUCTION AND RECYCLE OF METALS

Oak Ridge National Laboratory. J. C. Bravard, H. B. Flora, II, and Charles Portal. November 1972. 91 pages.

ORNL–NSF–EP–24

One of the major causes of the environmental crisis and the rapid rapid depletion of raw materials is the mismanagement of material resources from the viewpoint of total societal benefit. As part of a program involving the assessment of resource management alternatives, an evaluation has been made of the total energy expenditures in the production and recycle of important structural metals. This report provides the results of estimates of the energy requirements associated with the production of magnesium, aluminum, iron, copper, and titanium from their virgin ores as a function of ore grade. Energy requirements for the recovery of byproducts and the recycle of all these metals are also given. Particular emphasis is placed on the progressive increase in energy expenditures that will be required as the exhaustion of high-grade ore deposits force the utilization of progressively poorer ore grades; and the fact that the recycle of metal scrap in all cases requires considerably less energy than processing the metals from their ores.

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GENERATION OF STEAM FROM SOLID WASTES

Metcalf and Eddy, Inc; and City of Lynn, Massachusetts. 1972. 139 pages.

PB–214 166

Two pressing environmental concerns in many parts of the world today involve the disposal of municipal solid wastes and the need for new sources of energy. This report provides the results of an investigation of the feasibility of a municipality and a large industrial firm operating, as a joint venture, a solid waste disposal facility that would use municipal solid waste as a low-grade fuel to generate steam for use by the firm's facilities. The study was done from the standpoint of a particular city, Lynn, Massachusetts, but many of the considerations involved and methodological approaches should be applicable elsewhere. The topics covered include: basic design criteria; refuse generation; description of basic alternatives; units of the refuse processing system; units of the refuse burning system; manpower requirements; uniform refuse collection ordinances; cost estimates; economic evaluation; expansion and adaptability to other areas.

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ENGINEERING

Air Facilities

STRENGTHENING OF KEYED LONGITUDINAL CONSTRUCTION JOINTS IN RIGID PAVEMENTS

U.S. Army Engineer Waterways Experiment Station. R. W. Grau. March 1973. 128 pages.

AD–759 570

The multiple-wheel landing gear of large, new aircraft (such as the Boeing 747) impose loads on airfield pavements that are radically different from those previously encountered. It is known, for example, that conventional keyed longitudinal construction joints are inadequate for pavements constructed on low-strength subgrade and that pumping of fine-grained subgrade materials through the joints could cause failure of the joints and the pavement itself. Several methods are described in this report for strengthening keyed longitudinal joints in existing pavements to be subjected to multiple-wheel landing gear traffic. Methods are also described for adequately preparing the subgrades of new construction to increase the load-carrying capacity of a nonreinforced portland cement concrete pavement and to prevent the pumping of fine-grained subgrade material. A dowled longitudinal construction joint has been proven satisfactory and is recommended for use in pavement constructed on low-, medium-, and high-strength foundations.

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RATIONAL PAVEMENT DESIGN. PROCEEDINGS: ALLERTON PARK CONFERENCE ON SYSTEMS APPROACH TO AIRFIELD PAVEMENTS

Construction Engineering Research Laboratory. R. W. Woodhead, and R. H. Wortman (Editors). June 1973. 513 pages.

AD–763 212

The wide range of weights and ground control characteristics of present day aircraft have rendered inadequate the previously used combination of judgment and theory in designing airfield pavements. Extrapolations of pavement strength based on structure and slab support, with judgment factors added to compensate for lack of technological data and the difference in user requirements over time and varying service conditions must be replaced by new approaches and concepts in today's sophisticated situation. This report contains papers presented at a three day conference which brought together professional engineers, scientists, and mathematicians for discussion of interactive pavement design problems and their resolution. A few of the subjects considered are systems approach in engineering, operational surface requirements and failures, pavement maintenance, technical tools such as mathematical modeling and simulation, landing and take-off safety, construction methods, field studies, environmental factors, decision criteria and economics, tests methods and instrumentation, and research needs.

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PROCEDURES FOR DETERMINATION OF AIRPORT CAPACITY. VOLUME I.

McDonnel Douglas Corporation, Douglas Aircraft Company; McDonnel Douglas Automation Company; Peat, Marwick, Mitchell and Co.; and American Airlines, Inc. April 1973. 196 pages.

AD–763 593

PROCEDURES FOR DETERMINATION OF AIRPORT CAPACITY. VOLUME II. APPENDICES

McDonnel Douglas Corporation, Douglas Aircraft Company; McDonnel Douglas Automation Company; Peat, Marwick, Mitchell and Co.; and American Airlines, Inc. April 1973. 302 pages.

AD–763 560

One of the most critical problems confronting the air transportation industry is the existing and potential congestion of airport facilities, characterized primarily by aircraft delays attributable to insufficient capacity of airfield systems. A major step toward devising new and improved methods of increasing airport capacity is to develop reliable and generally usable planning tools which will provide a basis for determining how best to minimize congestion and increase capacity. This report describes some initial efforts made toward the realization of this goal. Definitions of airfield capacity and delay were refined, and models for determining airfield capacity and delay were developed. The models apply to runways, taxiways, and apron/gate areas. Volume I describes the main technical development, while Volume II consists of supporting appendices.

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Building Technology

EVALUATION OF THE COLUMN CONNECTIONS USED IN A PRECAST MODULAR HOUSING SYSTEM

National Bureau of Standards, Center for Building Technology. Felix Y. Yokel, and Thomas W. Reichard. March 1973. 90 pages.

COM–73–10855

The introduction of industrialized building systems may lead to the development of untried structural details which cannot be evaluated by analysis based on current design standards. Whenever deviations from design standards are proposed, the structural adequacy of the system must be determined by performance evaluation. This report presents the results of such a performance evaluation of innovative column connection details in a multistory housing system employing stacked precast reinforced concrete box modules. The innovative features of the column connections include: confinement of the concrete in the vicinity of the column bearings by reinforcing ties in order to increase concrete compressive strength; neoprene pads between column bearings in the upper stories; steel-neoprene-steel sandwich in the lower stories; and a grouted dowel through the center of the columns to provide resistance to tension and tear.

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BUILDING PRACTICES FOR DISASTER MITIGATION: PROCEEDINGS OF A WORKSHOP

National Bureau of Standards, Center for Building Technology. Richard Wright, Samuel Kramer, and Charles Culver. February 1973. 483 pages.

COM–73–50188

All building sites are subjected to some types of natural hazards, ranging in intensity from high winds, flooding, and storm surges to earthquakes and landslides. In addition there may be conflagrations or explosions, so that the design and use of a building must involve these various risks. Since buildings support and shelter most human activities, preventing building collapse is of major importance. Disaster mitigation denotes preventive measures to reduce the damages caused by the extreme environment of high winds and earthquakes and thereby mitigate human suffering. The proceedings of a 1972 National Bureau of Standards workshop at Boulder, Colorado, contain recommendations addressed to policy makers in government and industry as well as practitioners in engineering, architecture, land use planning, and earth-meteorological sciences. These recommendations involve current building practices, opportunities for improving technology, and possible research. Fifteen review articles are presented in the report, including a discussion of the maintenance of vital functions in buildings under conditions threatening disaster.

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GUIDELINES FOR SELECTION OF AND USE OF FOAM POLYURETHANE ROOFING SYSTEMS

National Bureau of Standards, Center for Building Technology. William C. Cullen, and Walter J. Rossite. May 1973. 48 pages.

COM–73–50523

During the 1960's, spray polyurethane foam attained a certain prominance as a roofing material. Basically, the roofing system consists of a sprayed-in-place polyurethane foam insulation combined with a protective cover. While this type of roofing may be used to definite advantage in many situations, it is not a panacea for all roofing problems. Heretofore little unbiased information has been available regarding the choice, application, advantages, and limitations of the foamed-in-place urethane roofing systems to assist those charged with design, construction, and maintenance responsibilities. Therefore, a project was conducted to survey the state of the art of polyurethane roofing technology. This document, which is a result of that survey, provides guidelines for the selection and use of polyurethanes for roofing applications. It also suggests a performance specification concerning the urethane foam system and its protective coating system.

LOGICAL METHODS OF BUILDING DESIGN. A SYNTHESIS AND REVIEW

Carnegie-Mellon University, Institute of Physical Planning. Charles M. Eastman. December 1972. 39 pages.

PB–214 653

Most previous work attempting an integrated view of building design has relied on a viewpoint based in decision theory. The inadequacy of this approach for developing a theory of design is that it focuses on singular decisions, whereas design involves a large number, most of which are interrelated. In this review, a framework for design is outlined which emphasizes classes of decisions and their interrelations. Design decisions are structured according to the form of description, or representation, which is used for making and evaluating them. A review is also provided of design decision making processes and formal methods for structuring those decisions. Relations between the different lines of research are emphasized.

Civil Engineering

INVESTIGATIONS OF VARIOUS SHAPES OF THE UPSTREAM QUADRANT OF THE CREST OF A HIGH SPILLWAY

U. S. Army Engineer Waterways Experiment Station, Hydraulic Laboratory. E. S. Melsheimer, and T. E. Murphy. January 1970. 29 pages.

AD–756 109

The design of spillways for overfall dams involves a study of crest pressures and discharge coefficients. The report covers an investigation concerned with the shape of the upstream quadrant of the crest of a high spillway. Tests were conducted to determine pressures and discharge coefficients with and without crest piers at heads varying from one fourth to one and one half times the design head. Limiting conditions for cavitation on the crest are defined. The discharge coefficients and crest pressures were observed on four shapes for the upstream quadrant. The treatment is mainly mathematical, and the data are presented in graphic form.

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EVALUATION OF THREE ENERGY DISSIPATORS FOR STORM-DRAIN OUTLETS

U. S. Army Engineer Waterways Experiment Station, Hydraulic Laboratory. J. L. Grace Jr., and G. A. Pickering. April 1971. 32 pages.

AD–756 110

Field performance studies of drainage and erosion control have indicated an urgent need for practical guidance in the selection and design of energy dissipators for drainage facilities. The research reported concerns an evaluation of the applicability and limitations of three of the most commonly used energy dissipators —a stilling well, the U. S. Bureau of Reclamation type VI basin, and the St. Anthony Falls stilling basin. Charts are presented for each type of energy dissipator, showing the maximum recommended discharge that will provide good performance for given outlet diameters and structure widths. Using the charts and other known parameters, the designer can select the type of dissipator best suited to protect a given outlet. Model tests, along with test facilities and procedures, are described and discussed.

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CONTROL OF SCOUR AT HYDRAULIC STRUCTURES

U. S. Army Engineer Waterways Experiment Station. Thomas E. Murphy. March 1971. 24 pages.

AD–756 152

Much work has been done on the development of energy dissipators for outfalls from hydraulic structures, and many good designs have been developed. However, even though these dissipators are used with structures ranging from relatively small drainage culverts to major spillways, in none of these designs is it contemplated that all of the excess energy of the efflux will be destroyed within the dissipator. Seldom does a designer ignore the fact that secondary dissipation outside of the structure itself is necessary but also seldom is due consideration given methods for accomplishing this. Common practice is to provide a trapezoidal outlet channel with bottom elevation the same as, or in some cases higher than, the top of the end sill and with bottom width the same as that of the energy dissipator and then attempt to stabilize this channel with riprap. Although large and thus costly rock is used in the area immediately below the dissipator, it is here that a great number of failures occur and costly maintenance is required to prevent damage to the structure or adjacent installations. This report demonstrates the advantages in providing for or preforming a "scour basin" in which flow can expand and dissipate its excess energy in turbulence rather than in a direct attack on the channel bottom and sides. Even a relatively small amount of expansion, preferably both vertically and horizontally, will greatly reduce the severity of the attack on the channel boundaries. This makes it possible to stabilize the channel with rock of an economical size and provide additional factors of safety against riprap failure and costly maintenance.

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STUDY OF A CONTINUOUS DRILL AND BLAST TUNNELING CONCEPT

Rapidex Incorporated. Carl R. Peterson. March 1973. 59 pages.

AD–757 114

A description is given of a new spiral technique for tunnel construction which was conceived to permit continuous drill and blast progress by means of frequent small blasts rather than the occasional large ones of conventional practice. Preliminary design work is presented for a combined drilling, loading, shooting, and mucking machine which stays at the tunnel face and will permit advance rates in excess of 13 feet per hour in an 8 x 8 horseshoe tunnel. Pie-slice sections of rock are blasted out by drilling axial holes in the rock face to the same depth, loading the holes with explosive, and shooting. When a full term is completed, the machine advances to the next location. The report discusses the basic spiral blast hole concept, typical blastic sequences, details of operation, rock face geometry and properties, blast distributions, miner layouts, and equipment.

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FULL-SCALE FIELD TEST RESULTS OF THE REAM CONCEPT FOR HARD ROCK EXCAVATION

Physics International Company. John D. Watson. January 1973. 70 pages.

AD–757 116

Various innovative methods of tunneling through hard rock are being investigated, including blasting, electron beams, lasers, water jets, and projectile impact. The report describes granitic rock disintegration by the REAM concept (rapid excavation and mining), in which the impact energy of high velocity projectiles is utilized for fracture and ejection. Inexpensive projectiles such as concrete or steel cylinders weighing ten pounds are accelerated to velocities of more than 5000 feet per second by conventional launchers, and by firing a number of these projectiles in a pattern a large amount of rock can be excavated in successive impacts. The report describes a demonstration in Hope Valley, California, in which a 13-foot diameter tunnel was driven to a depth of 26 feet, the average mass of rock removed by a 10-pound concrete projectile being 3000 pounds. A discussion is made of impact ejecta, muck distribution, and wall contour control. A preliminary economic and performance evaluation of the REAM concept is made for high speed tunneling.

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ANNOTATED BIBLIOGRAPHY OF EXPLOSIVE RELATED RESEARCH

U. S. Army Engineer Waterways Experiment Station, Explosive Excavation Research Laboratory. July 1972. 226 pages.

AD–757 157

This indexed bibliography contains abstracts of publications issued by the Explosive Excavation Research Laboratory, and its predecessor organizations, during the period 1962-72. The reports deal with the development of both chemical and nuclear explosive excavation design techniques and engineering procedures which can be used on a wide range of sizes and types of civil engineering excavation projects. Flexibility and adaptability in design procedures, engineering practicability, and cost competitiveness with conventional excavation methods have been the guidelines for the research represented by the reports. (Many of the reports listed are available from NTIS. Prices are available on request.)

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ROCK MECHANICS AND RAPID EXCAVATION USING EXPLOSIVES

AAI Corporation. Patrick E. Sweeney. May 1973. 122 pages.

AD–759 070

Much research is currently being devoted to finding a substitute for the drill-and-blast methods now almost exclusively used in hard rock tunneling and mining. Although these methods have improved over the years, their inherently cyclic nature imposes fundamental limitations on excavation rate, and it is desired to reduce costs. There is need to develop technology and equipment to obtain continuous operation. Rock disintegration is both the key to excavation and the major cost factor, while excavation rate is the limiting factor to rate of advance into a rock face. The report documents the development of an improved explosive drilling system to increase the excavation rate. The system utilizes a multi-jet explosive capsule incorporating seven shaped charge cone liners with a common explosive charge. The capsules are automatically and rapidly transported down a drill tube at a steady rate by water and high pressure air, with an ultimate rate of fire to be 600 explosions per minute producing 4200 jet penetrations per minute. Discussions are presented of a hydroballistic test rig, the drill rig, a three-capsule feed, an anti-sympathetic detonation buffer, water and air injection systems, fire control and support equipment, and the problems encountered in the tests of experimental models.

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DEVELOPMENT OF A CONCEPT FOR A HIGH CAPACITY PNEUMATIC CONVEYING SYSTEM EMPLOYING A FLUID ATTACHMENT DEVICE FOR USE IN UNDERGROUND EXCAVATION

Battelle Pacific Northwest Laboratories. A. K. Postma, J. D. Smith, and D. S. Trent. February 1973. 107 pages.

AD–759 403

A principal problem in underground excavation is removal of the excavated rock. The report discusses a new concept in which the crushed rock material is conveyed pneumatically, utilizing the Coanda principle of fluid flow. A small experimental model was found to be highly effective in entraining granular material in an air jet and transporting it through a cylindrical pipe to a receiver, achieving a carrying capacity of 4 tons per hour in an educator having a throat diameter of 2 inches, a value high enough to make the concept worth pursuing. The report presents the development of a mathematical model to predict the performance of such an ejector, involving dimensional analysis, similarity theory, and a vorticity transport method for solving the differential equations of fluid flow with axial symmetry. The characteristics of wall jet flow were noted with regard to the educator, and the experimental model provided a test of the validity of the mathematical one, as based on the properties of fluid flow attachment.

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EXPLOSIVE EXCAVATION RESEARCH

U. S. Army Engineer Waterways Experiment Station, Explosive Excavation Research Laboratory. Richard H. Gates. August 1972. 21 pages.

AD–761 719

The U. S. Army Corps of Engineers is developing explosive excavation as a construction technique for use on civil works projects. Large chemical charges are being used in multiple charge arrays in a variety of media and topographic situations to achieve actual construction projects. This document provides a review of the current status of explosive excavation techniques. Consideration is given to cratering phenomena; explosive excavation design; beneficial aspects of explosive excavation in terms of monetary savings, speed of construction, and environmental benefits; collateral effects such as ground shock, airblast, and ejecta; and the use of explosive excavation in actual civil works projects, including those involving the construction of channels, harbors, railroad cuts, channel plugs, and highway cuts.

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IDENTIFICATION OF POTENTIAL APPLICATIONS FOR ROCK-MELTING SUBTERRENES

Los Alamos Scientific Laboratory. D. L. Sims. February 1973. 19 pages.

LA–5206–MS

LARGE SUBTERRENE ROCK-MELTING TUNNEL EXCAVATION SYSTEMS. A PRELIMINARY STUDY

Los Alamos Scientific Laboratory. R. J. Hanold. February 1973. 38 pages.

LA–5210–MS

DESIGN DESCRIPTION OF MELTING-CONSOLIDATING PROTOTYPE SUBTERRENE PENETRATORS

Los Alamos Scientific Laboratory. J. W. Neudecker. February 1973. 22 pages.

LA–5212–MS

DESCRIPTION OF FIELD TESTS FOR ROCK-MELTING PENETRATION

Los Alamos Scientific Laboratory. R. G. Gido. February 1973. 17 pages.

LA–5213–MS

Rock-melting (subterrene) penetrators, which pierce rock or soil by melting rather than by chipping, abrading, or spalling, are under active development. This technique may offer enhanced penetration rates at significantly reduced cost. It also offers innovative alternatives for the manner in which the rock is originally minipulated, the nature and handling of debris, and the production of a hole casing. LA-5206-MS gives the results of an investigation of potential applications where rock-melting offers a logical extension to present excavation and drilling methods and, also, those areas in which rock-melting systems present new technological opportunities. Some applications include hole-punching in rock or soils for structural anchors, water well drilling in soft soils, core sampling in loose materials, mining, sinking of large shafts, oil and gas well drilling, and tunneling. LA-5210-MS discusses the established performance of conventional tunnel-boring machines and identifies a set of particularly costly and perplexing problems that seem to be amenable to solution by the rock-melting concept. The application of rock-melting technology to the conceptual design of large tunnel-excavation systems is also discussed. A class of devices called "melting-consolidating penetrators" has been perfected. LA-5212-MS describes such devices, includes engineering drawings, and gives detailed descriptions of operating characteristics, types of holes melted, typical refractory materials used, and fabrication costs for completed units. Field demonstrations of subterrene penetrators are described in LA-5213-MS. During these demonstrations, 51 mm holes up to 25 m deep were produced in a volcanic tuff. Both vertical and horizontal holes were made.

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STRENGTHENING OF FRACTURED ROCK PILLARS BY THE USE OF SMALL RADIAL REINFORCEMENT PRESSURES

Bureau of Mines, Denver Mining Research Center. B. T. Brady, and W. I. Duvall. 1973. 23 pages.

PB–221 901

The increasing use of large underground excavations in rock has created a great deal of interest in investigating factors affecting the stabilization and strengthening of underground openings. Essentially, the stabilizing of openings in fractured rock masses is governed by the extent to which the rock mass can be kept intact by the application of artificial supports. Low radial reinforcement pressures on the order of 1 psi applied to a fractured rock pillar are shown in this report to result in significant strength increases to the pillar. Specifically, the low reinforcement pressure applied by a rubber sleeve gives an average strength increase of 8% to the fractured pillar. The principal effect of the reinforcement pressure is to keep the broken and solid rock of the pillar together so that the broken rock can carry some of the load.

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Earthquake Engineering

EARTHQUAKE RESPONSE OF GRAVITY DAMS INCLUDING RESERVOIR INTERACTION EFFECTS

University of California, Earthquake Engineering Research Center. P. Chakrabarti and Anil K. Chopra. December 1972. 171 pages.

AD–762 330

The endurance of dams during earthquakes is extremely important because dam failure at such a time may be disastrous to life and property. It is thus necessary to develop means of evaluating a given structural design against a particular ground motion. The action and concepts will differ with the type of dam. The report deals with the gravity dam, a structure which depends upon its weight to resist the force of impounded water. Hydrodynamic interaction on dynamic behavior is reduced to two dimensions in mathematical analysis. The system is considered as two substructures: a finite element system, and a fluid continuum of infinite length upstream governed by a wave equation. Displacements of the dam are expressed in linear combination of the modes of vibration of the dam with the reservoir empty; and the effect of water in the reservoir on lateral displacement from an earthquake is examined. A computer program is introduced, and the vertical component of ground motion is studied as most important in gravity dam response.

ELASTIC-PLASTIC EARTHQUAKE RESPONSE OF SOIL-BUILDING SYSTEMS

University of California, Earthquake Engineering Research Center. Tadao Minami. August 1972. 163 pages.

PB–214 868

Utilization of high speed electronic computers and data obtained from earthquake observation networks has enabled the dynamic behavior of structures during strong motion earthquakes to be extensively analyzed and modeled, leading to changes in the concepts of antiseismic structural design. One such model is the well known spring-mass development with the base fixed, which some investigators have questioned with regard to soil-building interaction effects. Seismographs at the base of a building and at the free surface of the ground fairly close together have shown different characteristics related to building properties and the supporting media, and strong motion earthquake records have strongly reflected subsoil conditions at different observation stations. The report considers the effects of plastic soil deformation on the earthquake response of buildings, as shown by elastic-plastic finite element models. Nonuniform support excitations were generated statistically to reflect the soil-layer formation of downtown Tokyo, a lumped mass model of a building being attached through a massless rigid mat to the soil, represented by a set of finite elements arranged in three rows. Numerical results of elastic-plastic analyses for 3, 9, and 18 story buildings with and without basements were compared with those for corresponding elastic systems as well as buildings with the base fixed at ground level. The results are discussed and analyzed.

LITERATURE SURVEY-SEISMIC EFFECTS ON HIGHWAY BRIDGES

University of California, College of Engineering. Toshio Iwasaki, Joseph Penzien, and Ray W. Clough. November 1972. 434 pages.

PB–215 613

This report provides the results of a search of the world literature concerning the earthquake-resistant design of bridges, with specific attention to publications dealing with experience in Japan where the incidence of damage due to earthquake has been considerable.

Descriptions are given of the damage sustained to bridge structures in Japan (Kanto 1923, Nankai 1946, Fukui 1948, Imaichi 1949, Tokachi-oki 1952 and 1968, Miyagi 1962, Niigata 1964, Ebino 1968), Alaska (1964), New Guinea (Madang 1970), Chile (1971), and California (San Fernando 1971). Many of the more important investigations carried out to date on the seismic effects on bridges are reviewed and discussed. Finally, specifications for earthquake-resistant design of bridges, as currently used by many organizations, are presented. Emphasis is placed on Japanese specifications, with summaries also given of seismic regulations of 21 other countries of the world. These summaries indicate magnitudes of seismic coefficients being used and make note of certain factors which affect these magnitudes.

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EXPERIMENTAL INVESTIGATION INTO THE SEISMIC BEHAVIOR OF CRITICAL REGIONS OF REINFORCED CONCRETE COMPONENTS AS INFLUENCED BY MOMENT AND SHEAR

University of California, Earthquake Engineering Research Center. Mehmet Celebi, and Joseph Penzein. January 1973. 185 pages.

PB–215 884

The generally accepted philosophy for design of reinforced concrete structures in seismic regions requires that the structure suffer little or no structural damage when subjected to moderate ground shaking and that it remain serviceable even though heavily damaged when subjected to severe shaking. As a result of this philosophy, the reinforced concrete structures are expected to experience several cycles of load reversals in the inelastic range during major earthquakes. This document reports the results of a study of the seismic behavior of reinforced concrete components under reversal of combined moment and shear loading. These results are used to develop appropriate mathematical models. Also studied were the effectiveness of web reinforcement and the behavior of damaged components repaired by epoxy injection.

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PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON MICROZONIZATION FOR SAFER CONSTRUCTION RESEARCH AND APPLICATION. VOLUME I

National Science Foundation; UNESCO; University of Washington; American Society of Civil Engineers; and Academy of Mechanics. November 1972. 432 pages.

PB–216 070

Zoning for earthquake effects has come to be an accepted procedure in most parts of the world. There is, however, a definite need for a more detailed zoning procedure or *microzonation* to serve as a guide for safer land use and construction. A microzonation procedure would provide the general guidelines to be followed in a region and would form the basis for regulations for most structures. This document is one of two volumes comprised of papers presented at a conference on microzonation which was held in Seattle, Washington, 20 October-3 November 1972. Volume I contains papers dealing primarily with the state of the art, and with geology, seismology, and geophysics in relation to microzonation. Specific topics include the following: Zonation and microzonation; seismicity; strong motion seismology; soil and geologic effects on site response during earthquakes; soil dynamics —liquefication of sands; methods for determining site characteristics; geophysical engineering techniques for microzonation; Japanese microzonation methods; United States microzonation methods; microzoning program within the UNDP-UNESCO survey of seismicity of the Balkan region; evaluation of earthquake risk in Canada; Chilean experience in seismic microzonation; analysis of seismic risk on the site of special construction in Argentina; seismic regionalization or zoning; microzonation of New York state; microzonation case history of Grand Valley, Colorado; studies of strong earthquake motions and microtremor processes; microzonation for surface faulting; interpretation of seismic intensity data; method for the evaluation of seismicity; use of historical information for zoning and microzoning in the absence of instrumental data.

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PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON MICROZONIZATION FOR SAFER CONSTRUCTION RESEARCH AND APPLICATION. VOLUME II

National Science Foundation; UNESCO; University of Washington; American Society of Civil Engineers; and Academy of Mechanics. November 1972. 440 pages.

PB–216 071

This second volume of papers from the Microzonation Conference deals largely with soil mechanics, foundation engineering, engineering mechanics, structural design, urban planning, and government responsibility. The specific topics covered include: Microzonation in design of seismic structures; damage and risk analysis for the San Francisco Bay (California) area due to earthquake engineering; forecasting the risk inherent in earthquake resistant design; effects of soil and geological conditions on structural responses in the Osaka, Japan, area; ambient, aftershock, and mainshock responses of two high-rise buildings; selection of seismic design parameters for a nuclear facility; ground effect and dynamic characteristics of structures; application of computerized dynamic response simulation in earthquake engineering; reduction in soil strength due to dynamic loading; soil amplification studies in areas damaged by the Caracas, Venezuela earthquake of July 29, 1967; effects of site classification and distance on instrumental indices in the San Fernando, California earthquake; accuracy of modal superposition for one-dimensional soil amplification analysis; effects of seismic and subsoil conditions on earthquake response spectra; method for local seismic intensity zoning maps on the basis of subsoil conditions; field measurements of dynamic pore pressure during pile driving, shear modulus determination of soils by in situ methods for earthquake engineering; probabilistic approach to seismic zoning of an industrial site; definition of the geologic environment by remote sensing; description and evaluation of various techniques for making in situ wave velocity measurements; number of equivalent significant cycles in strong motion earthquakes; soil and earthquake uncertainties on site response studies; land use restrictions along the San Andreas Fault, California; techniques for seismic zoning; interdisciplinary approach for site evaluation in seismically active regions.

Highway Engineering

PAVEMENT DISTRESS IDENTIFICATION AND REPAIR

Construction Engineering Research Laboratory. E. J. Barenberg, C. L. Bartholomew, and M. Herrin. March 1973. 140 pages.

AD–758 447

This document is a compendium of available information on pavement distress, its causes, and methods of repair. The information is intended for use by technically trained but relatively inexperienced personnel to enable them to make rapid field identification of distress types for proper maintenance programming. All common distress types are covered for all classes of highway pavements, including major and minor highways, city streets, and parking lots. Much of the information is also applicable to airport runways and taxiways, but no attempt is made to include distress types that occur only in airport pavements. For each repair method, the following information is included: A suggested step-by-step procedure; equipment requirements; materials requirements; personnel requirements; relative cost; and probable effectiveness. An annotated bibliography of the relevant literature is also provided.

ACCELERATED SOUNDNESS TEST FOR AGGREGATE

Utah State Department of Highways, Materials and Tests Division. David K. Miles. July 1972. 88 pages.

PB–215 525

A necessary requirement of highway construction is the protection of embankments or cut slopes from erosion and scour. Such areas may be protected by means of adequately sized riprap of durable field or quarry stone. The riprap must be hard, sound, and free from defects in order to withstand weathering and wear during the life of the highway. It becomes necessary therefore to have means of evaluating potential riprap sources. The report holds that present standard specifications of evaluation appear too severe in some cases, resulting in the rejection of satisfactory rock. It discusses a proposed accelerated soundness test, the attempt being to find a test which correlates with the abrasion test and the current sodium sulfate test in use, and which accurately predicts the performance of rock types which are not well handled by the present tests. The test should determine accurately the effect of swelling clays on the deterioration rate of rocks. Experimental test results are compared with the observed field performance of rocks.

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ANALYSIS OF FOUNDATION WITH WIDELY SPACED BATTER PILES

University of Texas, Center for Highway Research. Awoshika Katsuyuki, and Lymon C. Reese. February 1971. 339 pages.

PB–215 617

A deep foundation supporting a bridge bent, or structure designed to carry both vertical and transverse loads, may depend for stability on metal or wooden piles driven into underlying soil. These piles may be oriented vertically or at an angle (battered). The mechanical behavior of such piles, singly and in combination, forms the basis for the present report. The treatment is mainly mathematical, and a theory for solving the displacement of a two-dimensional foundation with widely spaced batter piles under any arbitrary static loading is presented. The theory is capable of dealing with a highly nonlinear soil-pile interaction system as well as a nonlinear pile material. The most economical design of a pile foundation, including pile material, pile dimensions, and the arrangement of the piles in a foundation, can be found by the application of the analytical procedure described.

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RESILIENT BEHAVIOR OF ASPHALT TREATED BASE COURSE MATERIALS

University of Washington, Department of Engineering. R. L. Terrel, and S. Awad. August 1972. 228 pages.

PB–215 800

In many parts of the world, the design of flexible pavement is still based on emperical methods which have been developed from engineering experience. Increases of traffic in both volume and axial load, however, have lead to the failure of many roads

Highway Engineering
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originally considered well designed. It is obvious that a closer look at pavement materials is desirable in order to develop a rational design procedure. This document gives the results of such an examination of asphalt treated base (ATB) materials. ATB is a relatively low-quality base material, which may itself be used as a temporary pavement or be overlain with asphalt or portland cement concrete pavement. Its advantages over untreated base materials include reduced thickness and greater resistance to the effects of water and frost. An effort is made in this document to better define the properties at ATB, with emphasis on the determination of basic stress-strain relationships of this material in order to obtain the required parameters which can be used in a rational design procedure.

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Marine and Coastal Engineering

THE COMPUTATION OF TIDES AND CURRENTS IN ESTUARIES AND CANALS

Massachusetts Institute of Technology, Hydrodynamics Laboratory. D. R. F. Harleman and Chok-hung Lee. September 1969. 276 pages.

AD–756 136

THE COMPUTATION OF TIDES AND CURRENTS IN ESTUARIES AND CANALS. APPENDIX A. A USERS MANUAL

Massachusetts Institute of Technology, Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics. D. R. F. Harleman, and M. Llewellyn Thatcher. June 1973. 120 pages.

AD–762 613

One-dimensional tidal motion may be considered that in which the lateral boundaries of the system constrain the tidal motion to a direction which generally coincides with a centerline drawn between adjacent boundaries. Tides in long narrow gulfs or bays, fjords, estuaries, and sea-level canals can usually be treated in the one-dimensional category. This report concerns the one-dimensional tidal motion in variable-area estuaries and canals. A review and evaluation is provided of various analytical and numerical methods for the solution of tidal problems. An explicit, finite difference scheme is developed for nonlinear tidal motion in variable area estuaries and canals. The use of this numerical method is illustrated by seven case studies in which the calculated tidal elevations and velocities are compared with field or hydraulic model data. Separate computer programs are provided for (1) closed-end estuaries, (2) open-end estuaries, and (3) sea-level canals and embayments. These programs are combined into a single program in Appendix A. The latter document also provides a manual which will enable researchers and engineers to use the computer program in an effective manner. A knowledge of FORTRAN programming is helpful, but not necessary.

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DESIGN CONSIDERATIONS FOR SEAFLOOR FOUNDATIONS ON ROCK

Naval Civil Engineering Laboratory. P. J. Valent. June 1973. 29 pages.

AD–762 407

Many potential seafloor structure locations consist of exposed rock or rock with a thin sediment cover. The design of a fixed, bottom-resting structure in such an environment poses a substantial problem because of the unevenness of the bearing surface and the usual accompanying strong currents. This report identifies those rock foundation concepts most likely to succeed. Existing rock foundations are first described, previous peripheral studies are reviewed, and then a brief geologic review is made of seafloor rock characteristics. Foundation design recommendations for various rock surfaces are provided.

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A REVIEW OF LITERATURE ON ANCHOR BLOCKS AND LATERALLY LOADED PILES

National Oceanic and Atmospheric Administration, Marine Materials Technology Center. Gordon R. Keller and James M. Duncan. June 1971. 63 pages.

COM–73–10270

The technology of marine mining systems is very broad and diversified but basically it refers to interactions between machines and earth materials. The placement of objects on the sea bottom, whether they are anchors, platforms, or devices for mining operations is consequently important to ocean floor engineering and soil mechanics. The report reviews and summarizes the literature on the passive resistance of objects embedded in soil in a form useful for engineers. Some of the chapter topics are the passive resistance of anchor blocks and the breakout resistance of embedded objects, the analysis and design of laterally loaded piles, pile-load tests, the notations employed in subgrade reaction analysis, and the symbols used. An annotated bibliography is included.

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5TH NATIONAL SEA GRANT CONFERENCE PROCEEDINGS

Texas A and M University, Center for Marine Resources. Exa Ellis, Kathi Jenson, and Len Faseler (Editors). 1973. 263 pages.

COM–73–10400

This document is comprised of papers and addresses presented at a conference of representatives of university marine research programs supported by the U. S. Government. Some of the topics covered include: total utilization concepts in fish processing; ocean technology trends; problems associated with deep-water ports; probable directions of marine terminal development in the near future; recreational role of advancing oceanic education; new drugs from the sea, the state of the art; review of Law of the Sea Conference activities.

Marine and Coastal Engineering (continued)

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ISOLATION OF PIPING FROM PUMP VIBRATIONS

Mechanical Engineering

Virginia Polytechnic Institute. L. D. Mitchell. November 1972. 105 pages.

AD–757 431

When piping is connected to pumping systems, unwanted vibration and/or noise can be transmitted from the pump to the pipe and ultimately to a working or living space as noise. The low frequency vibration induced in piping can be large and can cause damage and pipe failure. This document provides guidelines for effective selection and installation of flexible pipe connectors or resilient pipe hangers in an effort to minimize or eliminate this problem. The topics covered include: Source of the problem; design procedure; severity of the problem; concepts of isolation; connector selection; flexible connector installation; and test procedures.

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STRESS ANALYSIS MANUAL

Technology Incorporated. Gene E. Maddux, Leon A. Vorst, F. Joseph Giessler, and Terence Moritz. August 1969. 574 pages.

AD–759 199

Stress analysis is an extensive field of mechanical engineering which involves almost all structural forms and machinery operations. The manual contains a collection of stress analysis techniques from a wide variety of sources. It references many publications which contain information pertinent to the subject; and it lists the nomenclature most commonly used. The wide range of topics includes, for example, elastic and plastic bending; shear and instability; tension fields; rivets; moments, reaction forces, and loading; beam torsion; helical springs; equations and mathematical modeling; crippling stress; arches; thin shells, cylinders, and spheres; compression and internal pressure; thick walled vessels; bushings; pins; fatigue analysis; transmissions; and empirical treatments. A subject index is included.

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TESTING METHODS AND TECHNIQUES: QUALITY CONTROL AND NONDESTRUCTIVE TESTING. A COMPILATION

Nondestructive Testing

National Aeronautics and Space Administration, Technology Utilization Office. 1973. 24 pages.

N73–20528

A variety of devices and techniques useful in nondestructive testing have been developed by or for the U. S. National Aeronautics and Space Administration. This document briefly describes 36 of these which may have application outside of the aerospace industry. Each item represents either a potential saving in cost and time, or improvement in inspection quality over past techniques. The methods and techniques described each fall into one of the following categories: weld and braze inspection; leak detection; and adhesive bonding and composite materials inspection. No patent action is contemplated on the technology described. NASA will furnish additional details on individual items upon request.

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PROCEEDINGS OF THE INTERDISCIPLINARY WORKSHOP ON NONDESTRUCTIVE TESTING—MATERIALS CHARACTERIZATION

U. S. National Science Foundation; U. S. Air Force Materials Laboratory; and North American Rockwell Science Center. April 1973. 505 pages.

AD–760 174

This report is comprised of papers presented at a workshop, held in November 1972, on nondestructive testing and materials characterization, with emphasis on new approaches that may lead to significantly improved future capabilities. A secondary objective of the workshop was to discuss ways of transferring nondestructive testing technology to the civil sector of the economy and to identify some of the current nondestructive testing methods that are suitable for transfer from high technology industries to those based upon the traditional technologies. The topics of the papers, which are mostly tutorial in nature, include: coupling laboratory problems to engineering phenomena; problems that are uniquely associated with metal and alloy systems; failure in polymeric products; operational demand for nondestructive testing (NDT) systems; currently used NDT material characterization techniques; impact of NDT materials characterization on design, manufacture, and repair; theoretical concepts in wave propagation applied to dynamics of elastic structures and to testing; optical effects arising from electronic band structure in metals; acoustic magnetic resonance and the study of microstructural effects in metals; new technology for surface characterization; computer aided NDT; quantitative NDT standards for flaw detection; characterization of flaws and defects in structural metals; characterization of intrinsic properties of engineering importance; characterization of interfaces; evaluation of existing and potential NDT techniques.

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ENGINEERING PROPERTIES OF CLAY SHALES. REPORT 1. DEVELOPMENT OF CLASSIFICATION INDEXES FOR CLAY SHALES

U. S. Army Engineer Waterways Experiment Station. W. Heley, and B. N. MacIver. June 1971. 102 pages.

AD–756 123

Confusion in the description and definition of clay shale results from the variable character of the material and the subjectivity of most classification methods. It is inadequate to distinguish only "good" shales from "bad" shales; rather, standardized indexes are required for the quantitative classification of shales. This report is directed toward the problem of classification indexes and determination of residual shear strength for clay shales. Characteristics of clay shales are reviewed with regard to construction and maintenance problems. Currently used classification indexes, both qualitative and quantitative, are defined and discussed, together with recommended methods for determining them. In some definitions, arbitrary and specific restrictions are introduced to provide standardization.

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NOTES ON PROVING RINGS AND FRAMES FOR SOIL TESTING EQUIPMENT

U. S. Army Engineer Waterways Experiment Station. M. J. Hvorslev. March 1972. 48 pages.

AD–756 199

Data on design, construction, and use of proving rings and frames for measurement of forces or loads in laboratory and field tests on soils have been compiled or developed in the course of many years. A summary of these data is presented in this report. The first section provides equations and diagrams for determination of deflections and moments in proving rings and frames of various types. The influence of secondary factors, such as appreciable deformations and thickness, corner fillets, creep and hysteresis, and temperature changes, are discussed in the next section. The final sections present examples of actual and possible application of the data of the preceding sections, and include a discussion of suitable materials for proving rings and frames.

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SOIL MECHANICS DESIGN. STABILITY OF SLOPES AND FOUNDATIONS

U. S. Army Engineer Waterways Experiment Station. April 1967. 61 pages.

AD–756 351

This publication provides a comprehensive presentation of methods for analyzing the stability of earth foundations and unretained slopes. Also included are discussions of various critical conditions which influence such studies. Sections are devoted to: Stability considerations; earth foundation failures; slope failures; analysis of earth foundations; analysis of earth slopes; design criteria and safety factors. The publication is intended as a summary of design methods, rather than as a design manual.

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A NEW METHOD FOR DETERMINING THE PHYSICAL PARAMETERS OF LARGE SOIL AND ROCK SAMPLES IN SITU

Air Force Cambridge Research Laboratories. Emmanuel E. Bliamptis. December 1972. 29 pages.

AD–756 830

Rock and soil testing under laboratory conditions has been developed to a satisfactory status over the years, but experimental investigations in the field have not been as satisfactory and have failed to match the laboratory measurements. One important consideration is that the field materials are larger in size and contain irregularities, while the laboratory sample testing has tended to ignore such factors as cracks, joints, voids, weak regions and inclusions although these affect mechanical and electrical properties. A new method is described for large scale testing by which a set of linear electrodes is placed in boreholes forming a square pattern. Application of positive and negative electric potentials on alternate electrodes creates a set of symmetry planes for regions with straight sides or cells. The presence of inhomogeneity and anisotropy is reflected by unequal currents in geometrically equivalent cells. Mechanical parameters of the cells are obtained by analogous techniques. A mechanical disturbance is generated in the central borehole, and the travel time to outlying boreholes is measured along with attenuation. Elastic stiffness constants are computed from the density-velocity squared relation and correlated with the electrical quantities.

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INFLUENCE OF SUCTION ON HEAVE OF EXPANSIVE SOILS

U. S. Army Engineer Waterways Experiment Station. Lawrence D. Johnson. April 1973. 83 pages.

AD–759 903

Certain types of soils swell upon sorption of moisture, causing the surface to heave up. This differential heave can result in severe damage to overlying structures. A measure of the force causing these expansive soils to imbibe moisture is given by the magnitude of the negative pore water pressure—or suction—in the pore water in the soil, but information of the influence of suction has so far been limited. The report describes an investigation to determine the influence of suction pressures on heave in some expansive soils beneath structures. An important part of the project was developing a pressure membrane apparatus which could simulate and measure in situ action in expansive clay soils. Test results are discussed with regard to vertical loads, water content, degree of saturation, voids, and permeability. The effects of cyclic wetting and drying are not included.

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TENSILE TESTING OF SOILS: A LITERATURE REVIEW

U. S. Army Engineer Waterways Experiment Station. M. M. Al-Hussaini and F. C. Townsend. May 1973. 113 pages.

AD–760 433

Engineering practice with regard to soil and stabilized subbase materials has been mainly concerned with compressional and shear forces, with little or no attention to tensile forces. Tensile stresses are recognized in structures such as rigid and flexible pavements, dams, and embankments, but previous research has been concerned with brittle materials such as concrete and rock. Since tensile stresses can be high enough to produce cracks in structures, present efforts to provide crack-free highway and airfield pavements, dams, and embankments have led to investigation of the subfoundation soils for tension. No standard tests or procedures are presently available for evaluating the tensile strength of soils, so an investigation has been made of factors involved in testing techniques and devices. The report discusses the direct tensile test, the flexure or beam test, the indirect or split tensile test, the ring tensile or hollow cylinder test, the cohesiometer test, the double punch test, and the centrifugal force test, including theory and assumptions.

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LIME-CEMENT COMBINATION STABILIZATION

Construction Engineering Research Laboratory. Lovick P. Suddath. May 1973. 40 pages.

AD–762 552

Soil stabilization is used rather extensively in road and airfield construction in tropical regions. The use of soil cement is one way in which this stabilization may be effected. As the plasticity of a soil increases, the ability to adequately mix the cement with the soil becomes a critical factor. Also, the quantity of cement required to stabilize the soil becomes excessive. It is well known, however, that addition of lime to highly plastic soils results in a reduction in plasticity and an improvement in workability. Thus, the possibility exists of using a combination stabilization method which utilizes lime to improve the workability of the soil and portland cement to form the cement agent. There has been some question on the effect of lime on the durability of soil cement. It is demonstrated in this report that although the lime reduces the density of soil cement, it does not impair the durability of cement stabilized clay soils. Furthermore the use of lime increases both freeze-thaw resistance and compressive strength of soil cements. It is emphasized that the lime-cement combination will save construction time, reduce the volume of stabilizer required, and furnish a better stabilized layer.

SOIL POLLUTION: EROSION EFFECTS IN SOIL

Defense Documentation Center. July 1973. 390 pages.

AD–763 500

This bibliography is comprised of abstracts of reports generated by U. S. Government-funded research on the damaging effects of erosion on soils. The reports deal with erosion by wind, water, ice, avalanches, landslides, earthquakes, helicopter downwash, exhaust gases, and other forces; and cover procedures for the protection, stabilization, preservation, and restoration of earth materials exposed to erosion. Subject, title, and author indexes are included. The reports listed in this bibliography are available from NTIS (prices furnished upon request).

FOG MODIFICATION—A TECHNOLOGY ASSESSMENT

Air Force Cambridge Research Laboratories. Bernard A. Silverman and Alan I. Weinstein. March 1973. 45 pages.

AD–762 207

Fog, one of the oldest hazards to shipping and transportation, is even more hazardous in the present high speed era, motivating an intensive search for methods of artificial fog dispersal. Three general types are ice fog which occurs at temperatures below –30 C., supercooled fog in the form of liquid droplets below 0 C., and warm fog occurring at temperatures above freezing. The report makes a comprehensive review of fog modification, outlining requirements and methods for removal, evaporation, and prevention. Visibility, the principal factor connected with the phenomenon, is inversely related to fog particle concentration and size. Fog droplet removal has not proved to be practical because of the large energy required, and prevention has not yet been successfully developed. Thus evaporation remains as the feasible method. Some of the topics discussed are seeding technology for supercooled fog and warm fogs, helicopter downwash mixing and ground based heating for warm fogs, and controlling the sources which lead to ice fog formation. Airport operations are reviewed, and the need for further experimentation is shown.

AN ANNOTATED BIBLIOGRAPHY OF STUDIES ON CLOUDS, FOG, AND VISIBILITY IN INDIA: 1940-1970

National Oceanic and Atmospheric Administration, Environmental Science Information Center. Annie E. Grimes. July 1972. 49 pages.

COM–73 11034

An annotated bibliography is presented of studies on clouds, fog, and visibility in India. The materials cover such topics as visibility at night, photographic studies of cloud forms and their time changes, diurnal variations in visibility, cloud geometry, fog and mist and haze, peculiarities in forecasting, cloud types, earth electric fields, cold wave and dust haze, waterspouts and tornados, dusty weather, statistical distributions problems in predicting, cloud seeding, horizontal and vertical visibility, air turbulence, radar observations, fog characteristics for various localities, radiosonde observation, jet landings, thunderstorms, and cloud heights.

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UNDERGROUND COAL MINING METHODS TO ABATE WATER POLLUTION: A STATE OF THE ART LITERATURE REVIEW

West Virginia University, Coal Research Bureau. L. W. Wilson, N. J. Matthews, and J. L. Stamp. December 1970. 51 pages.

PB–214 697

This report encompasses a literature survey of acid mine water abatement and mining hydrology, both with respect to underground coal mining operations. Mine water management is examined from the aspects of preventing water entry, preventing formation of acidic waters, underground water treatment, and water removal. Sealing methods and unique methods in deep mines are discussed. Finally, attention is drawn to those areas where further research efforts might be applied.

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WATER POLLUTION ASPECTS OF URBAN RUNOFF

American Public Works Association. January 1969. 271 pages.

PB–215 532

A study was conducted to determine the factors in the urban environment which contribute to the pollution of urban storm water runoff and to determine methods of limiting this source of water pollution. Particular attention is paid to street refuse and litter. Pollution load as measured in terms of biochemical oxygen demands (BOD) has been estimated in a municipality such as Chicago in terms of average daily load and the shock pollution load on the receiving body of water. The influence of such factors as catch basins, combined sewers, regulations, costs of prevention and treatment, and public cooperation all receive attention in the discussion. Some recommendations are made, including the control of roof runoff drainage, improving street cleaning practices, minimizing the effects of yard and garden debris, minimizing the effects of chemicals and better labor-management relations. A few guidelines are also presented.

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FISHERIES

AMPHIPODA (HYPERIIDEA) DISTRIBUTION AND ABUNDANCE OFF THE COAST OF CENTRAL WEST AFRICA

National Marine Fisheries Service, Southeast Fisheries Center. Joseph E. Tashiro and Jack W. Jossi. October 1972. 38 pages.

COM–73–10067

Pelagic amphipods contribute to the food of certain commercially important species in temperate areas. The distribution and abundance of these planktonic crustaceans are charted for 53 station positions off the coast of central West Africa.

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A STUDY OF THE FEASIBILITY OF ESTABLISHING A DISTANT-WATER FISHING INDUSTRY IN PUERTO RICO

Robert E. O'Brian, Inc. 1973. 78 pages.

COM–73–10795

A study has been carried out to determine whether or not it would be feasible to establish a distant-water fishing industry in Puerto Rico. Much of the information obtained during the course of the study may be of interest to those concerned with this general problem elsewhere in the world. The term "distant-water", as used in the context, is taken to indicate all fisheries other than those operating within approximately 100 miles of the coast of the study area. A review was made of distant-water fishing enterprises which developed in Europe and Asia since World War II. What is known of the existing biological resources in the Caribbean and tropical West Atlantic areas was analyzed, and the present and probable future competition for these resources was examined. The report provides a review of what distant-water fishing means today, including a description of fishing enterprises in Spain and Cuba. Considerable attention is given to the questions of (1) which fishing-related operation look most economically attractive, and (2) how they might be initiated.

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OCEAN FISHERY MANAGEMENT: DISCUSSIONS AND RESEARCH

National Marine Fisheries Service, Division of Economic Research. Adam A. Sokoloski (Editor). April 1973. 181 pages.

COM–73–11098

It has only been within recent years that economics, with its emphasis on rational management, has gained some respectability in the fisheries community beyond mere conceptual discussion. A workshop was convened in November 1970 in order to aid in assimilating the results of work accomplished on fishery management problems, and to provide some sense of proper future direction for both research and the design of management programs. This report is comprised of papers presented at that workshop. The topics include: problems in implementing new fishery management programs; utility of bioeconomic models for fisheries management; cross section production functions for North Atlantic ground fish and tropical tuna seine fisheries; optimal fishing effort in the Peruvian anchoveta fishery; the production function for the sea; constructing a bioeconomic model for fishery management; management problems of the Peruvian anchoveta resource; stochastic investment model for a survival-conscious fishing firm.

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A MULTIPLIER FOR COMPUTING THE VALUE OF SHELLFISH

Federal Water Pollution Control Administration. Edward F. M. Wong. October 1968. 21 pages.

PB–215 218

If the value of shellfish areas and the economic benefits available from the production and commercial procession of the shellfish are known, the protection necessary to maintain the resource, and the assessment of losses sustained by the community should this resource become unavailable can be determined. This report describes a simple method for determining the economic value of a community's commercial shellfish production or its potential worth. An estimating tool, or multiplier, is presented by which a mathematical relationship is derived, including such factors as landed value or price paid directly to the fisherman, value added between the wholesaler and retailer within the harvesting community and outside of it, community value, and total value. Formulae and tabular data are included, along with mathematical derivations, and the example of shellfish production in one community.

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FOOD AND NUTRITION

RADIATION-STERILIZATION OF FOOD: A STATISTICAL ANALYSIS

U. S. Army Natick Laboratories. Edward W. Ross, Jr. March 1973. 59 pages.

AD–760 486

This document is concerned with the determination of safe sterilization processes for canned food, i.e., processes which ensure that the food is free of dangerous organisms. Although ionizing radiation is the method of sterilization considered here, the mathematical procedures described are equally applicable to any method of killing microorganisms in food. The report describes the inadequacies of the currently recommended procedure, and shows that certain changes in both the experimental design and the mathematical treatment will permit a much improved estimate of the required sterilizing dose. Some mathematical background is necessary for understanding the document, which utilizes random variables, their associated distribution functions, and the relations among them.

DETERMINATION OF TRICHINELLAE IN PORK

Los Alamos Scientific Laboratory. Paul M. Giles. April 1973. 10 pages.

LA–5246–MS

This document describes two methods which are under development for the surveillance of slaughterhouse processing of pork for the detection of trichinellae infestation. One method, the "projection method", involves (1) pressing a glycerol-treated sample of meat, (2) mounting it between glass slides, (3) projecting it in the same manner as a photographic slide, and (4) visually inspecting the projected image. In its current state of development, this method can be used on a production line to provide a visual inspection within three minutes. With further development, this time may be reduced to one minute at a cost of about 5 cents (U. S.) per animal inspected. A second method, the "digestion method", involves separating trichinellae from meat, and then counting the individual trichinellae. This method is at present more time consuming and more costly than the projection method.

SINGLE-CELL PROTEIN FROM WASTE CELLULOSE

Louisiana State University, Department of Chemical Engineering. C. E. Dunlap, and C. D. Callihan. January 1973. 81 pages.

N73-15115

Cellulose, in its many forms, comprises the bulk of both the volume and weight of all municipal, industrial, and agricultural wastes. This document is the final report on a four-year effort to develop a process to convert waste cellulose, primarily from agriculture waste fibers, to single-cell-protein suitable for use as a food supplement or additive (a previous report, N70-42445, is described in AMTID, January 1972, page 6). The process basically involves the depolymerization of the lignin, followed by microbial fermentation. Included in the report are a discussion of factors involved in substrate selection (availability cellulose content, cost, biodegradability, and others); the treatment of cellulosics; the effect of treatment on solids; process feed conditions; organisms and inoculum preparation; nutrients; batch fermentation; continuous fermentation; product harvesting; and plant flow sheets.

PLANNING NATIONAL NUTRITION PROGRAMS: A SUGGESTED APPROACH. VOLUME I—SUMMARY OF THE METHODOLOGY

American Technical Assistance Corporation. January 1973. 43 pages.

PB–224 002

Malnutrition has only recently been identified as a stumbling block to national development. Many governments are beginning to include nutrition goals in national development plans. This Volume presents an approach which will assist nutritionists and national planners to evaluate the implications of current development projects and create new interventions. The methodology presented is brief. It is intended for busy planners who want to understand the principles of a systematic planning approach. The approach assumes that the planning process can be started quickly and inexpensively—with data already existing in the country. Nutrition planners must be ready to cut across traditional bureaucratic boundaries to acquire the support of national policy planners and make claims on the resources of existing agencies. This Volume may be used independently of Volume II, which is not currently available.

DOSIMETRY, TOLERANCE, AND SHELF LIFE EXTENSION RELATED TO DISINFESTATION OF FRUITS AND VEGETABLES BY GAMMA IRRADIATION

University of Hawaii, College of Tropical Agriculture. James H. Moy. December 1971. 50 pages.

UH–235–P–5–X–1

This report provides the results of a seven-year study which was undertaken to determine the dosimetry, tolerance dose, quality retention, nutritional adequacy, and post-irradiation changes as related to disinfestation and shelf-life extension of fresh fruits and vegetables by gamma irradiation, with special emphasis on tropical products. Orientation was toward commercial processing of high quality products for export. The fruits and vegetables involved in the study were papaya, passion fruit, banana, mango, pineapple, lychee, soursop, avocado, ginger, sweet potato, and soybeans.

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MANAGEMENT

MANAGEMENT: THE PLANNING PROCESS

Air Force Institute of Technology. James L. Quinn. January 1972. 44 pages.

AD–757 184

Management is discussed in a series of reports, of which this is the first, as a three-fold system, including the setting of objectives, policies, and decisions; the processes of planning, organizing, directing, and controlling; and bonding by communication to tie all these together. The report is directed to the planning function. It discusses needs, concepts, means and ends matching, decision making frameworks, and system input-outputs. The definition of a plan is given, along with a description of plan heirarchy by which broad coverage is spread out to specific references throughout the organizational network. Also included are types of plans, goals and objectives, repetitive and nonrepetitive actions, planning cycles, programming, and long range operations.

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MANAGEMENT: THE ORGANIZING PROCESS

Air Force Institute of Technology. Alan J. Goldstein. January 1972. 52 pages.

AD–757 185

Management is the function of getting things done through people in the best and cheapest way. The management system is one in which the elements are intricately related with one another. A series of reports considers this system as a three-dimensional model in which one dimension consists of establishing objectives, policies, and decisions; the second comprises planning, organizing, directing, and controlling; the third contains the bonds of communication typing all the others together. The report considers the processes of organization. It covers management system characteristics; systems analysis; organizing processes; formal organizing including division of labor; levels of authority; departmentalization and project operating; centralization or decentralization of decision making; bureaucracy characteristics; and informal or unplanned organization which arises from social interactions.

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MANAGEMENT: THE CONTROLLING PROCESS

Air Force Institute of Technology. James L. Quinn. January 1972. 48 pages.

AD–757 186

Management, the science of getting people to do the proper things in the best and cheapest way, requires due processes of control. The report discusses controlling as one of three intricately related elements in the management system, the other two being formulation and communication. It includes characteristics of a management system; processes, functions, uses, and elements of control; control standards and concentration areas; measurement and evaluation of current activities; prevention of present and future deviation from set plans; information systems involving feedback, data storage, and report making; and organizational boundaries and decision making circuits.

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MANAGEMENT: DECISION-MAKING

Air Force Institute of Technology. James L. Quinn. January 1972. 24 pages.

AD–757 187

The report is one of a series of monographs relating to the science of management. The decision making process is discussed as one element in a three-dimensional system consisting of formulating, implementing, and communicating. It includes systems analysis; definition, scope, and tools in the decision making process; intelligence activities such as searching the environment for conditions calling for decisions; design activity involving the invention, development, and analysis of possible courses of action; and choice activity or selection of a particular course of action from those available. Collectively the several monographs in the series provide an integrated overview of management.

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MANAGEMENT: COMMUNICATING

Air Force Institute of Technology. James L. Quinn. January 1972. 43 pages.

AD–757 188

The fifth report in a five volume series of monographs on management covers the process of communicating, by which all the elements of management are bound together. The system is viewed as a three-dimensional one in which objectives and policies and decisions are established, and planning and organizing is accompanied by direction and control. Included in the discussions are materials on the communicating process involving definition, meaning, basic dimensions, purposes, and objectives; criticism and barriers including mechanical and psychological ones; formal and psychological ones; formal and informal communication structures; unidirectional and bidirectional flow structures; networks, and channels; and programs and media of communication, including verbal and written modes, audits, and surveys.

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MACHINING DATA AND ENGINEERING GUIDELINES (REVISED)

Metcut Research Associates. October 1972. 996 pages.

AD–756 365

This document is comprised of an extensive set of data sheets concerning speed, feed, rate, tool material, geometry, and coolant for a wide variety of conventional and unconventional machining operations. Engineering guidelines are provided for machinability, economy, surface integrity, controls, analysis of vibration, and machine tool dynamics. The data and guidelines are applicable to a wide range of metals, alloys, and plastic materials. The following specific types of operations are covered: Turning, drilling, boring, operations on holes, threading, planing, broaching, sawing and slitting, abrasive cutoff, gear machining, and grinding.

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ELECTRODEPOSITION: A BIBLIOGRAPHY

Defense Documentation Center. March 1973. 282 pages.

AD–756 750

The bibliography contains abstracts of reports of U. S. Government-funded studies on methods of coating metals and composites by electrodeposition. General subjects include electroforming, coatings, thin films, magnetic materials, electrolysis, cermets, and composite materials. Some of the specific topics are alloys, refractory metals, ceramics, oxides and nitrides, ultrasonics, computer technology, electron properties, display devices, vapor plating, graphite, dielectric materials, hardening, semiconductors, electronic circuits, mechanical properties, test methods, manufacturing methods, symposia, nuclear radiation, surface properties, electrochemical systems, batteries, powder metallurgy, thermal properties, and solutions. (The reports listed in this bibliography are available from NTIS. Prices will be supplied on request.)

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ELECTROPLATING: A BIBLIOGRAPHY

Defense Documentation Center. March 1973. 145 pages.

AD–756 800

The bibliography contains abstracts of reports of U. S. Government-funded studies on electroplating. General subjects are electroplating solutions, metal coatings, corrosion inhibition, metal films; alloys of aluminum, titanium, nickel, chromium, and magnetic metals; composite materials, hydrogen embrittlement, zinc, silver, gold, nickel, cadmium, and porous metals. A few specific topics are electrodeposition, cermets, steel protection, heat treatment, ceramic coatings, mechanical properties, computer technology, thermal stresses, fuel cells, metalorganic compounds, electron beams, x-ray analysis, test methods, impurities, radioactive materials, filaments, carbides, microwave properties, thermoelectric materials, electronic equipment, reentry vehicles, mathematical models, molten salt electrolytes, bearings, oxides, and surface properties. (The reports listed in this bibliography are available from NTIS. Prices will be furnished on request.)

ARC WELDING (INDUSTRIAL PROCESSING SERIES)

Defense Documentation Center. June 1973. 88 pages.

AD–760 970

This bibliography is comprised of abstracts of reports generated as a result of U. S. Government-funded research on arc welding. Included within the scope of the bibliography are reports on spot welding, gas metal arc welding, inert gas welding, pulsed arc welding, and gas tungsten arc welding. Subject, title, and author indexes are included. The reports listed in the bibliography are available from NTIS (prices furnished on request). This document supersedes a previous bibliography of the same title, AD-722 765, which was described in AMTID, April 1972, page 56.

ETCHING

Defense Documentation Center. July 1973. 190 pages.

AD–763 100

This bibliography is comprised of abstracts of reports of U. S. Government research on etching. The reports deal primarily with the capabilities and limitations of etching techniques (including chemical milling), materials for which they are suitable, and the various etchants and solutions used in the process. Emphasis is on the etching of alloys and semiconductor materials. Subject, title, and author indexes are included. The reports listed are available from NTIS (prices furnished upon request). This bibliography supersedes an earlier one of the same title, AD-703 200, which was described in AMTID, January 1972, page 43.

ADHESION BONDING

Defense Documentation Center. July 1973. 98 pages.

AD–763 200

The bibliography contains abstracts of reports generated as a result of U. S. Government-funded research dealing with adhesion bonding of metals, composite materials, and crystals. General topics of interest include techniques and effectiveness of manufacturing methods, process development, and quality control of sealing compounds and adhesives. Some of the specific topics discussed are surface properties, deformation, cracks, and stresses; films; spacecraft, rocket, and aircraft components; dissimilar materials, joints; polymers and plastics, wood, alloys, types and dynamics of seals and sealing, thermal properties, evaluation and test methods, mathematical models, fibers, and glass textiles. Subject, title, and author indexes are included. The reports listed in this bibliography are available from NTIS (prices furnished upon request). For a bibliography of reports on adhesion bonding issued prior to 1970, see AD-704 525 in AMTID, January 1972, page 29.

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SPUTTERING (INDUSTRIAL PROCESS)

Defense Documentation Center. July 1973. 224 pages.

AD–763 600

Sputtering, the deposition of thin metallic films by ion bombardment in a gas discharge tube evacuated to low pressure, may be used to coat both metallic and nonmetallic surfaces, including glass. The bibliography contains abstracts of reports generated by U. S. Government-funded research on this technique as used in industrial processes. General subjects covered are metal films, integrated circuits, thin films, capacitors, resistors, transistors, and dielectrics, as well as plasma physics, inert gas technology, and vacuum operations. Some of the specific topics discussed are chemical compounds, electrodes, crystals, manufacturing methods, ion and electron beams, miniature electronic equipment, instrumentation, substrates, bonding and welding, thermal and surface properties, spacecraft components, and vapor plating. Subject, title, and author indexes are included. The reports listed in the bibliography are available from NTIS (prices furnished upon request). This document supersedes a previous bibliography on this subject, AD-703 900, which was described in AMTID, January 1972, page 44.

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MATERIALS

GUIDE FOR PRESSURE GROUTING CRACKED CONCRETE AND MASONRY STRUCTURES WITH EPOXY RESINS

Construction Engineering Research Laboratory. J. D. Fuller, and J. D. Kreigh. February 1973. 45 pages.

AD–755 926

This manual is intended as a guide for purchase, performance, and use of epoxy materials by those engaged in the maintenance and repair of cracks in concrete and masonry structures. It is intended to aid in the proper selection and employment of appropriate materials, equipment, and practices; the component inspection and evaluation of the work done; and the use of proper safety precautions. The text of the guide covers both technical discussion and application procedures in order to aid the engineer in making decisions whether or not to utilize pressure grout and, if so, by what method. The procedures apply to both above and below ground portions of houses, warehouses, technical buildings, special buildings, roads, runways and any other concrete or masonry structure. They do not apply to surfaces immersed in water or other liquid.

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INVESTIGATION OF CEMENT-REPLACEMENT MATERIALS. REPORT 13. USE OF WATER-REDUCING AND WATER-REDUCING/RETARDING ADMIXTURES IN MASS CONCRETE

U. S. Army Engineer Waterways Experiment Station. W. O. Tynes. November 1966. 34 pages.

AD–756 131

INVESTIGATION OF CEMENT-REPLACEMENT MATERIALS. REPORT 15. TEMPERATURE RISE OF MASS CONCRETE MIXTURES

U. S. Army Engineer Waterways Experiment Station. W. O. Tynes. November 1967. 28 pages.

AD–756 132

One possible way of reducing the cost of mass concrete is by using large amounts of pozzolan with a small quantity of cement. Such concrete is sufficiently workable, but it can be marginal in strength. A number of water-reducing admixtures are commercially available and these, through lowering the effective water-cement ratio, ought to increase the strength of the concrete. These reports provide the results of an investigation of the effects of water-reducing admixtures on certain parameters of high-pozzolan, low-cement mass concrete mixtures. The water-reducing admixtures involved in the study included salts of lignosulfonic acid, modifications and derivatives of the preceding, and salts and hydroxylated carboxylic acids. Report 13 deals with the effects of these materials on the workability, heat generation, strength, cost, and other characteristics of the concrete. Report 15 supplements the above with a discussion of adiabatic temperature-rise data. The properties of the concretes studied were found to be as good or better than control concretes, and they may offer distinct advantages in some applications. For example, with a mixture containing only 73 lb. of portland cement per cubic yard it would be possible to obtain a concrete with a 3000-psi compressive strength at 90 days with a temperature rise of about 20 F.

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MATERIALS AND PROCEDURES FOR THE REPAIR OF SPALLS IN CONCRETE

Construction Engineering Research Laboratory. Robert F. Kemphues. March 1973. 20 pages.

AD–759 132

Concrete spalling, usually the surface or edge deterioration of concrete units, may result from adverse environmental effects, collisions, freeze-thaw action, or the corrosion of reinforcing bars. It generally occurs at joints, the cement binder generally remaining sound but crack propagation rendering the concrete structure locally unsound. The report considers old and new materials used for repairing such damaged or deteriorated concrete. Survey results are used to develop an evaluation matrix to show repair material performance. It was found that large damaged areas can be successfully and economically repaired using a good quality, low slump portland cement concrete bonded to the old concrete with an epoxy resin grout, and that small spalls and specialized areas can be repaired with an epoxy resin mortar. Other materials and their performance are noted.

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INVESTIGATION OF CEMENT-REPLACEMENT MATERIALS. REPORT 10. USE OF LARGE AMOUNTS OF POZZOLANS IN LEAN MASS CONCRETE

U. S. Army Engineer Waterways Experiment Station. William O. Tynes. August 1962. 34 pages.

AD–756 299

INVESTIGATION OF CEMENT-REPLACEMENT MATERIALS. REPORT 14. USE OF LARGE AMOUNTS OF POZZOLANS IN LEAN MASS CONCRETE (SECOND PHASE)

U. S. Army Engineer Waterways Experiment Station. William O. Tynes. October 1966. 40 pages.

AD–756 185

These reports provide the results of studies which have demonstrated that satisfactory concretes can be produced using just one bag (97 lb.) of portland cement per cubic yard, provided that an optimum amount of pozzolan is included in the mixture. Report 10 provides data on the properties of the concretes obtained when various proportions of pozzolanic material (volcanic glass, opaline shale, diatomite, or fly ash) were used with mixtures containing one bag of portland cement per cubic yard. These properties include water requirements, slump, air content, bleeding, compressive strength, permeability and heat of hydration. Report 14 contains data from field studies of selected high-pozzolan concretes; information on the adiabatic temperature rise of the subject mixtures; and permeability data from 1-year old specimens. High-pozzolan lean concretes appear to be acceptable for use in the interior of gravity dams.

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FIBROUS CONCRETE—CONSTRUCTION MATERIAL FOR THE SEVENTIES

Construction Engineering Research Laboratory. B. H. Gray, G. R. Williamson, and G. B. Batson (Editors). December 1972. 246 pages.

AD–756 384

Fiber reinforced concrete is concrete made of hydraulic cements containing fine or fine plus coarse aggregate and discontinuous discrete fibers. The fibers may be metallic, organic or inorganic, but the most common are steel, glass, plastic, and natural materials (such as asbestos and cotton). This document is comprised of papers of a conference, held in May 1972, which brought together workers in the field of fibrous concrete and, also, those engaged in concrete work in general and who could possibly find applications for fibrous concrete. The papers cover both the state-of-the-art and pavement applications. The specific topics include: Introduction to fibrous concrete; mix design considerations; field considerations; steel fiber production and related considerations; steel fiber optimization; current status of the use of glass fibers in concrete; flexural strength predictions; steel fiber reinforced regulated-set concrete; pavement applications of fibrous concrete; pavement performance investigation; pavement design considerations; construction of fibrous concrete overlay of airport pavements; driveway, road, and airport slabs.

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TECHNICAL INFORMATION PAMPHLET ON USE OF FIBROUS CONCRETE

Construction Engineering Research Laboratory. G. R. Williamson, and B. H. Gray. May 1973. 16 pages.

AD–761 077

Fibrous concrete is conventional concrete with randomly dispersed fibers or short length and small cross-sectional area. This document provides guidelines for the use of fibrous concrete by field personnel. A large number of different materials may be employed as the fibrous component; however, fibrous concrete made with steel fibers has wider application and overall superior properties to that made with other materials. For that reason, only steel fibers are discussed in this document. Included is information on the types and properties of fibrous concrete, types and sources of steel fibers, and typical mix design procedures. Specific information is provided on the handling and batching of steel fibers; concrete quality control; and concrete placing, finishing, and curing. Consideration is also given to costs and to promising applications.

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THE PREPARATION, PROPERTIES, AND POTENTIAL APPLICATIONS OF CONCRETE-POLYMER MATERIALS

Brookhaven National Laboratory, Department of Applied Science; and U. S. Bureau of Reclamation, Division of Research. M. Steinberg, and J. E. Blackstrom. May 1970. 33 pages.

BNY–14764

Preformed mortar and concretes can be fully impregnated with a monomer and polymerized by either gamma radiation or thermal catalytic techniques. The resulting material, termed "concrete-polymer", has been found to have substantially improved structural and durability properties compared with those of conventional concrete. Possible applications of concrete-polymer materials include sewer and pressure pipe, building material for housing, underwater structures, railroad ties, and chemically resistant material of construction for large desalination plants. A review is provided in this report of several aspects of these materials, including: concrete-polymer preparation techniques; polymerization techniques; strength and durability of concrete-polymer; lightweight concrete-polymer; monomer addition to premix concrete; value of concrete-polymers and potential applications.

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Glass

STRENGTHENING OF GLASS BY AN ELECTRONIC TECHNIQUE

Naval Ordnance Laboratory. D. A. Kubose, H. A. Perry, and J. E. Tydings. December 1972. 30 pages.

AD–757 333

Glass
(continued)

The theoretical strength of glass has been estimated to be on the order of 106 psi. However, glass in usage is found to possess only a small fraction of this theoretical strength. The reason for this degradation in strength is the existence of numerous flaws and fissures on the surface of the glass. In order to increase the strength of glass, it is imperative to treat the surface of the glass to negate the effect of these flaws. This can be achieved by placing the surface of the glass in a state of high compression. This report describes a method of producing a relatively deep surface compressive layer by using an electric field to drive alkali ions from a molten salt bath into the glass to replace the small resident alkali ions. The process appears to be best suited to thick sections of glass.

GLASS WOOL FROM WASTE GLASS

Tuscaloosa Metallurgy Research Laboratory. Alan H. Goode, M. E. Tyrrell. January 1973. 20 pages.

PB–214 642

One area of solid waste utilization research lies in the recovery of glass from municipal incinerator residues. The report deals with the production of glass wool from this recovered glass. A process is described in which incinerator residue glass, uncalcined dolomite, and alumina were mechanically blended, placed in a silicon carbide crucible with 3/16 inch and 1/4 inch diameter orifices in the bottom for making fine and coarse fiber wools, and fused in a melting furnace. When the batch was sufficiently fluid a plug in either orifice was removed and the molten glass flowing out was fiberized by impingement of a jet of compressed air. The principal test variable investigated was composition of the melt. Attention is called to the fact that variations in chemical composition or purity are relatively unimportant to the uses of the glass wool thus produced.

Metals and
Metallurgical
Processing

TITANIUM ALLOYS HANDBOOK

Battelle Columbus Laboratories, Metals and Ceramics Information Center. R. A. Wood, and R. J. Favor. December 1972. 644 pages.

AD–758 335

This handbook contains a wide range of information of interest to the engineer working with or designing for titanium alloys. Commercially available titanium alloys are described in terms of their physical metallurgy, processing technologies, and typical design-engineering mechanical properties. The interrelationships between fabrication and heat treatment variables and their effects on structures and resulting mechanical properties are described. The availability of the various product forms is given in terms of typical suppliers, dimensions, and expected tolerances. Detailed consideration is given to the various machining, forming, and joining techniques that may be used with titanium alloys.

METALLURGICAL PROCESSING. A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1973. 24 pages.

N73–20593

A number of innovative metallurgical processing techniques have been developed by or for the U. S. National Aeronautics and Space Administration. This document briefly describes 35 of these which have potential for application outside the aerospace industry. Included are processes that are general in scope and applicable to a variety of metals and alloys and, also, processes that concern specific metals and their alloys. Most of the processes are free from patent restrictions. NASA will supply additional information on specific processes upon request.

MATERIALS DATA HANDBOOK. STAINLESS STEEL TYPE 301. (2nd Edition)

Western Applied Research and Development, Inc. R. F. Muraca, and J. S. Whittick. April 1972. 106 pages.

N72–30462

Type 301 is the lowest alloyed member of the 18% chromium 8% nickel series of steels, belonging to the larger family of austenitic stainless steels. These austenitic Fe-Cr-Ni alloys, which were first developed in Germany during the years 1909-12, have excellent resistance to corrosion as well as good creep-resistance at elevated temperatures and good cold formability. Type 301 is used in the construction of aircraft, buses, trucks, trailers, and railroad cars. It is also used for automobile wheel discs, architectural trim, flashing, and roof drainage products. This handbook presents a summary of the materials property information presently available on stainless steel Type 301. Its scope includes physical and mechanical property data at cryogenic, ambient, and elevated temperatures, supplemented with information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication and joining techniques. Design data are presented, where available, and these data are complemented with information on the typical behavior of the alloy. The material is presented in the form of tables and figures, with descriptive text provided as appropriate.

CLEANING TITANIUM ALLOY CHIPS

Bureau of Mines, Boulder City Metallurgy Research Laboratory. O. Q. Leone, and D. E. Couch. 1973. 22 pages.

PB–214 761

Recycled titanium scrap is mixed with titanium sponge for ingot production and, therefore, plays an important role in the production of mill products. The steel industry also consumes some titanium scrap as an additive in steel. In both cases, the scrap material must be free from contaminants. This report describes a process for the complete cleaning of scrap titanium alloy chips. The process uses solvent degreasing, magnetic separation, and anodic solution of nonmagnetic impurities.

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MOLTEN SALT ELECTROWINNING OF MAGNESIUM-YTTRIUM ALLOYS

Bureau of Mines, Reno Metallurgy Research Center. E. Aamland, D. J. MacDonald, and D. G. Kesterke. 1973. 15 pages.

PB–214 783

Magnesium-yttrium alloys containing more than 35 weight-percent yttrium have a particular utility as master alloys for preparing construction materials having rare-earth metals as minor constituents and as intermediates in the production of pure rare-earth metals. A method has now been developed for the electrolytic preparation of alloys of this type. It involves the electroreduction of Y_2O_3 dissolved in a molten YF_3 electrolyte and the subsequent deposition of yttrium in a floating magnesium cathode. Alloys containing up to 55 weight-percent yttrium have been prepared at cathode current efficiencies of 21 to 60%. Cell design and operation are described in this report, and some of the limiting conditions pertaining to the method are discussed.

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DEVELOPMENT OF LOW COST, CORROSION RESISTANT ALLOYS AND OF ELECTROCHEMICAL TECHNIQUES FOR THEIR PROTECTION IN DESALINATION SYSTEMS

Tyco Laboratories, Incorporated. F. H. Cocks, A. H. Taylor, and S. B. Brummer. December 1972. 243 pages.

PB–215 265

This document reports the results of a research program which was undertaken to develop and characterize Cu-Zn alloys for water desalination applications and to investigate electrochemical protection methods applicable to both Cu-Zn and the more usual Cu-Ni alloys. The aim was to produce materials of lower cost, greater strength, better thermal conductivity, and better corrosion than are presently available. This objective was achieved with alloys of the Cu-Zn-Ni-Al family, further modified by the addition of Fe and Mn. Corrosion screening tests have shown an improvement of a factor three for these alloys, as compared to arsenical aluminum brass in saline at 268 F. The new alloys have the added advantage that they can be fabricated soft and strengthened by thermal treatment to yield strengths in excess of 140,000 psi. These strength properties are such that the use of these alloys in applications other than desalination may be advantageous. A practical electrochemical protection system has not yet been achieved.

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Miscellaneous Materials

DEVELOPMENT OF LAMINATION FABRIC MATERIALS

American Cyanamid Company. Darwin DeLapp. August 1972. 26 pages.

AD–756 457

Known fabric type materials that can be designated “waterproof”, in the sense that they prevent the passage of water, also excessively impede the transmission of water vapor. Hence, whenever such materials are used for clothing, normal perspiration is trapped close to the wearer’s skin and cannot be evaporated. A requirement thus exists for materials suitably convertible into various kinds of apparel which will keep a person dry, both by shedding rain and by allowing body moisture to evaporate into the environment. A material has now been developed which apparently meets these requirements. It consists of an extruded porous sheet of material, comprised of a blend of 90% poly(1-butene) and 10% poly(tetrafluoroethylene), laminated between two layers of polyethylene fabric. The laminate exhibits a hydrostatic water resistance of 21.5 psi, moisture vapor transmission of 590 g/m^2, and a total fabric weight of 5.2 oz/yd^2. The feasibility of large scale manufacture has been demonstrated. The document discusses the properties, material production, and process development of the new fabric.

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VENEER SPECIES OF THE WORLD

Department of Agriculture, Forest Products Laboratory. 1973. 154 pages.

AD–764 294

The veneer and plywood industry is developing rapidly throughout the world, and many countries have important national and international markets for these products. Many other nations, some of which are not yet producers of veneer and plywood, are exporters of large quantities of veneer logs. This report provides a compilation of available information on the various species of the world that are suitable for the production of veneer and plywood. The data, which are presented in tabular form, come from government laboratories in various countries. The information provided for each species includes: Botanical name; common name or names; where the timber grows; estimated timber volume; specific gravity; green moisture content; ease of cutting; bolt conditioning; dry veneer characteristics; widthwise shrinkage; color and figure of veneer; and relative suitability for use.

HIGH TEMPERATURE SOLID LUBRICANTS—WHEN AND WHERE TO USE THEM

Lewis Research Center (NASA). Harold E. Silney. April 1973. 25 pages.

N73-20537

During the past 25 years, much effort has been directed to the study of solid lubricants. Those materials have solved many unique lubrication problems. However, the misapplication of solid lubricants has not been uncommon. This document describes some of the relevant properties of various solid lubricants for use in moderate and severe environments. The lubricating materials covered include: layer lattice compounds (MoS_2, WS_2, graphite, and graphite fluoride); the high-temperature polyimide polymers; and calcium fluoride based coatings and composites. Lubricating properties, stability in various environments, and relevant machine design considerations are discussed.

A MATERIAL SELECTION METHOD BASED ON MATERIAL PROPERTIES AND OPERATING PARAMETERS

Langley Research Center (NASA). Wolf Elber, and John R. Davidson. April 1973. 14 pages.

N73–21452

During the design process, a material must be chosen. Some material properties which are considered while making the choice are the ultimate strength, the yield strength, the facture toughness, the fatigue strength, and the crack-growth resistance. Some of these control design, some do not. The intended operating parameters—which include desired life under cyclic loads, operating stress, and nondestructive inspection capability—influence the relevance of the properties. This report shows, by means of an analytical development, how the operating parameters and material properties are interrelated. From the analysis, materials can be compared, and the most appropriate one chosen for the intended use. The underlying philosophy is developed, the material properties which are relevant in various applications are shown, and the manner in which design curves can be developed for use in material selection is illustrated.

ELASTOMERS FOR SERVICE WITH ENGINE LUBRICANTS AND HYDRAULIC FLUIDS

Horizons Incorporated. K. A. Reynard, R. W. Sicka, J. C. Vicic, and S. H. Rose. June 1973. 47 pages.

AD–762 800

A critical need exists for a reversion resistant elastomeric material capable of service in synthetic or petroleum-based oils and fluids over the temperature range –65 F to 350 F. Poly(fluoroalkoxy phosphazenes) have shown great promise for service in these environments. Data which confirm this premise are contained in this report. The synthesis of the polymer and the compounding of base stocks are described. The compounded stocks are suitable for use as O-rings, gaskets, and seals. Test data indicate that in terms of fluid, fuel, and high humidity resistance, the poly(fluoroalkoxy phosphazenes) exceed the performance of fluorosilicones. The poly(fluoroalkoxy phosphazenes) also are very close to the fluorosilicones in terms of compression set resistance, even though the fluorosilicones are less highly filled.

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PLASTIC PIPE FOR INTERIOR AND EXTERIOR COLD WATER DISTRIBUTION SYSTEMS

Construction Engineering Research Laboratory. Walter J. Mikucki. May 1973. 28 pages.

AD–763 902

Research in the field of plastics has produced materials which have become competitive, technically and economically, with metals. The report deals with the suitability of plastic piping for use in conducting potable cold water in both exterior and interior distribution systems. The light weight, corrosion resistance, and low cost of plastic pipe, plus cost savings in fabrication, handling, and installation make its use increasingly attractive, particularly as conventional materials become scarcer and more expensive. The discussion is limited to unreinforced piping of four inches inside diameter or less. Three major resins are considered: polyethylene for low pressure applications only, acrylonitrile-butadiene-styrene, and polyvinyl-chloride, the latter two being able to withstand a pressure of 150 psi. Some problem areas are noted. Study findings relate to performance, material, and mechanical characteristics; methods of joining, cutting, and shaping; resistance to degradation; costs; installation techniques and constraints; and inspection, storage, and testing.

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EVALUATION OF GRP ROD AND ROPE MATERIALS AND ASSOCIATED END FITTINGS

National Bureau of Standards, Institute for Basic Standards. Nixon

Halsey, Richard A. Mitchell, and Leonard Mordfin. December 1972. 94 pages.

COM–73–10853

Glass reinforced plastic (GRP) rod and rope products are becoming widely used as a substitute for steel materials in various fields, offering in some cases more favorable characteristics. GRP rod and rope are strong, flexible, lightweight, non-conducting, corrosion resistant, and inexpensive. For example GRP rope has been used for tethering high-altitude balloons and for deep-sea moorings of oceanographic buoys. GRP rod has been used as guy strain insulators. Both the rod and rope have been used instead of steel for entire guy lines and other elements of large communications towers and antenna arrays. An extensive and varied test program was conducted on four GRP rod and rope materials to evaluate tensile strengths, moduli of elasticity, flexibility at low temperatures, effects of simulated Aeolian vibration, and stress-rupture properties at moderately elevated temperature on long-term storage were noted, and diameter-temperature relationships were established for avoiding buckling due to storage in a coiled condition. The performance of five commercially available end fittings attached to these materials was examined, and an improved end fitting was developed capable of approaching the true tensile strengths of two of the GRP materials. Implications are discussed.

CHEMISTRY TECHNOLOGY: ADHESIVES AND PLASTICS. A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1973. 25 pages.

N73–23630

This publication is one of a series which is issued for the purpose of disseminating information on NASA-generated technological developments which have a potential utility outside the aerospace community. It contains brief descriptions of (1) a group of chemical formulations having to do with the production or improvement of adhesives, and (2) a group of polymeric plastics that feature special characteristics or that are produced by innovative methods. Additional information on individual items is available upon request from NASA. Most of the technology described is free from patent restrictions.

STANDARDIZATION AND MEASUREMENT SERVICES IN TURKEY

National Bureau of Standards; and Agency for International Development. H. Steffen Peiser, R. J. Corruccini, and S. B. Newman. October 1972. 85 pages.

COM–73–11175

This report summarizes the activities, findings, and recommendations of a multinational team which conducted a survey of standardization and measurement services for developing industries in Turkey. Particular attention is given to the organization and functions of the Turkish Standards Institute. Consideration is also given to the technical service function services needed in industrializing. These include standards development, test methodology, product certification, product testing, calibration, weights and measures control, export control, quality control, industrial extension, building codes, international contracts, and publications.

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STANDARDIZATION AND MEASUREMENT SERVICES IN KOREA

National Bureau of Standards; and Agency for International Development. June 1972. 43 pages.

COM–73–11287

A group of experts from Ecuador, Korea, Turkey, and the U.S.A. conducted a survey of standardization and measurement services in Korea during June 1972. This document is a report of that survey. It discusses aspects of Korea's economy and key institutions relevant to the survey; national institutions for standards, measurement, and quality control; and problems of concern to the survey team on a national capability in standardization and measurement services. A fairly extensive series of recommendations is provided.

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NATIONAL PROGRAM FOR METROLOGY FOR ETHIOPIA

National Bureau of Standards, Institute for Applied Technology. Thomas M. Stabler. 1972. 23 pages.

PB–222 533

The Ethionian Standards Institution (ESI) was established in 1970 to promote the development of a centralized national system of standards. In addition to its basic function of preparing and publishing compulsory and voluntary standards relating to practices, processes, materials, products, and commodities, ESI has the responsibility of developing a weights and measures program in Ethiopia. This report is the result of a survey of the Ethiopian weights and measures program status and needs which was undertaken at the invitation of ESI by an export from the U.S. National Bureau of Standards. A plan is proposed for a weights and measures program for Ethiopia. Consideration is given to the provisions of the current weights and measures proclamation and regulation, special factors in Ethiopia that would affect a weights and measures program, personnel requirements, and technical education requirements.

REPORT TO AID ON THE NBS/AID WORKSHOP FOR THE SURVEY TEAM OF NATIONAL CAPABILITIES FOR STANDARDIZATION AND MEASUREMENT SERVICES IN INDUSTRIALIZING ECONOMIES

National Bureau of Standards. H. Steffen Peiser (Editor). April 1972. 47 pages.

PB–222 554

Many of the problems faced by newly industrializing countries in establishing an effective infrastructure of measurement technology and standardization for production and quality control are similar. Because of this, a team comprised of experts from Ecuador, Korea, Turkey, and the U.S. was organized to survey the capabilities of industrializing nations in the fields of standardization and measurement. A workshop attended by members of this team was held at the U.S. National Bureau of Standards headquarters during April 1972. This document summarizes the activities of that workshop. Emphasis in the workshop and the survey program was on the maintenance of national standards of measurement, field surveillance of weights and measures, procedures for the development of standards, and inspection and quality control of production. The report also contains a paper entitled “A Survey of Standardization in Turkey”, and a paper which surveys the activities of the Instituto Ecuatoriano de Normalizacion and the standardization needs of Ecuador.

STANDARDS IN NUCLEAR SCIENCE AND TECHNOLOGY. A BIBLIOGRAPHY

U.S. Atomic Energy Commission, Technical Information Center. September 1973. 239 pages.

TID–3336

This bibliography is comprised of abstracts of 1803 publications from throughout the world concerning a broad range of standards used in nuclear science and technology. Most of the publications were issued in the time period 1962 through 1972. The abstracts are arranged in chronological order within four categories: Engineering and Reactors (safeguards, radioactive waste, vacuum technology, welding, etc.); Instrumentation and Calibration (neutron sources, standard neutron fluxes, standard cells, instrumentation methods, etc.); Radiation and Radiation Protection (biological shielding, radioactive materials shipping, etc.); Miscellaneous (geologic and chemical standards, measuring units other than radiation, etc.). A subject index is included.

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MISCELLANEOUS AND INTERDISCIPLINARY REPORTS

OPPORTUNITIES IN HIGH-PRESSURE TECHNOLOGY

National Research Council, National Materials Advisory Board. January 1973. 228 pages.

AD–760 714

A discussion is provided of those aspects of high-pressure technology likely to have expanding impact on materials research and development, and those aspects of high-pressure research most likely to lead to significant applications, in the near future. Major emphasis is placed on applications of static high-pressure, although shock-wave work is also discussed briefly. Consideration is given to the present situation in high-pressure science, synthesis, sintering, densification, devices, polymer properties, dynamic high-pressure processes, and development of high-pressure equipment. In addition, a number of individual papers on the following specific topics are appended: High-pressure sintering; powder consolidation; dynamic high-pressure applications; calibration of the supported taper cell for electrical work; superconductivity; ferromagnetic materials; dielectric and ferroelectric materials and applications; high-pressure technology and magnetism; very high pressures used in polymer technology; electronic phenomena at high pressures.

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PHOTOGRAPHY EQUIPMENT AND TECHNIQUES. A SURVEY OF NASA DEVELOPMENTS

Franklin Institute Laboratories, Science Information Services Department. Albert J. Derr. 1972. 188 pages.

N73–18437

The U.S. space program has considerably extended the capabilities of photography, both with respect to the development of new equipment and techniques and the utilization of existing photographic tools in new applications. This extended capability has been applied to community planning and ecology, for example, as well as to space and engineering. This review of new photographic technology generated by the space program is provided for general interest reading, as well as in the hope of suggesting potential solutions to problems for society, for various government groups, and in many fields of technology. The subject areas covered include: advances in hand-held photography, including the development of highly reliable fully automatic hand-held cameras and a unique technique for photogrammetric data analysis from hand-held photography; the use of cameras mounted in aircraft and spacecraft; the application of engineering photography to a diversity of research programs, demonstrating the flexibility of photographic systems for the recording and display of technical information; multispectral photography as a technical tool; photographic earth resources investigations; survey of film characteristics and the typical films use in NASA operations; and special film handling techniques. A glossary of English-language terms used in photography is appended.

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SIGNIFICANT NASA INVENTIONS AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES

National Aeronautics and Space Administration. 1973. 59 pages.

N73–24947

This publication contains abstracts of fifty inventions owned by NASA and which are available for licensing outside of the U.S. Although all of the items were developed in conjunction with the U.S. aerospace program, many of the inventions (or the principles embodied therein) should find application in other fields. For each invention, an address is provided where additional information concerning the invention or information regarding applications for license can be directed.

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ATOMIC AND MOLECULAR PHYSICS

National Research Council, Committee on Atomic and Molecular Physics. 1971. 142 pages.

PB–214 566

This report describes activities and current problems in the field of atomic and molecular physics. Its purpose is to acquaint administrators of science, scientists in other fields, students and nonscientists with the content of atomic and molecular physics and its contributions to knowledge and application. The development of this field is described from the early discoveries in atomic spectra at the end of the last century to the many varied and complex experiments of today. It is shown how this field relates to a variety of current practical and scientific problems that often have immediate bearing on our lives. In addition, results are presented of a two-year study of the activities and current problems of atomic and molecular scientists.

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REMOTE SENSING

PROCEEDINGS OF THE EIGHTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT. VOLUME I.

Environmental Research Institute of Michigan, Center for Remote Sensing Information and Analysis. October 1972. 814 pages.

AD–761 559

This Volume is comprised of papers presented at a symposium held at the University of Michigan in October 1972. The subject matter includes the use of remote sensing by various local and national governments for economic development purposes; various applications in monitoring and managing the earth's resources and environment; ground-based, airborne, and spaceborne sensor systems; and manual and machine-aided data analysis and interpretation. Volume II of this report is not currently available.

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THE USE OF REMOTE SENSORS TO RELATE BIOLOGICAL AND PHYSICAL INDICATORS TO ENVIRONMENTAL AND PUBLIC HEALTH PROBLEMS

University of West Florida. September 1972. 182 pages.

N73-16060

This document is the result of a project which was undertaken to determine what reliable relationships exist between biological, ecological and botanical structures, and disease organisms and their vectors which might be detected and measured by remote sensing. A general discussion is provided of the types of diseases which are and are not suitable for this kind of analysis. This is followed by in-depth discussions of four major health problems whose detection and investigation can be approached through remote sensing techniques. These are: spotted fever, encephalitis, malaria, and "red-tide." A bibliography of relevant literature is provided for each of these areas, with abstracts being included for the more important references.

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INTERNATIONAL WORKSHOP ON EARTH RESOURCES SURVEY SYSTEMS, MAY 3-14, 1971. VOLUME I

National Aeronautics and Space Administration, Scientific and Technical Information Office. 1972. 359 pages.

N73-16348

INTERNATIONAL WORKSHOP ON EARTH RESOURCES SURVEY SYSTEMS, MAY 3-14, 1971. VOLUME II

National Aeronautics and Space Administration, Scientific and Technical Information Office. 1971. 611 pages.

N73–16382

These volumes contain materials which were prepared for presentation at a workshop which was organized to describe the Earth Resources Survey Program of the U.S., its content, techniques and results, and its future plans. The potential contributions of remote sensing data to the solution of resource problems and the experimental material which is expected to become available to other countries were also discussed. Representatives of forty countries and fifteen international organizations attended the workshop. Volume I contains the texts of 37 speeches and papers presented during the first week of workshop sessions. Volume II is comprised of 27 papers presented during the tutorial sessions of the second week. It is intended as a reference document on the application of earth resources satellites to agriculture, forestry, cartography, geography, environmental quality, geology, hydrology, and oceanography.

A STUDY OF METHODS FOR LOWERING AERIAL ENVIRONMENTAL SURVEY COST

SCI Systems, Incorporated. James R. Stansberry. January 1973. 116 pages.

N73–18369

The application of conventional aerial survey methods to problems of a more restricted nature leads to a relatively high cost per unit data obtained. Conventional techniques, with aircraft suited for conventional aerial survey or mapping, are limited in maneuverability in a limited geographical area, and crew and operating costs tend to be expensive. This report provides the results of a study of the feasibility of practical lower cost approaches to perform aerial surveys in both rural and urban environments. The problems associated with a low cost aerial survey system are defined, and typical missions are postulated to serve as a basis for candidate systems to be compared. A discussion of sensor equipment is presented, and the problems associated with control, stabilization, and navigation are discussed. Take-off and recovery problems are discussed, and a summary of the legal and safety aspects is presented. A survey of equipment is provided, including a wide spectrum of possible candidate aircraft, engines, controls, and support equipment. The acquisition and operating costs of the various systems are estimated. Finally, a primary selection of survey vehicles is performed. These include a radio-controlled model-type aircraft in the 60 to 80 pound class, a light manned aircraft, and a radio-controlled blimp. Each of these vehicles is suitable for somewhat different types of applications.

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REMOTE SENSING AND PHOTO INTERPRETATION

University of Washington. J. E. Colcord. March 1972. 40 pages.

PB–214 864

Photo interpretation may be defined as the examination of photographic (sensor) imagery for the purpose of identification of objects (targets) and judging their significance by a scientific decision process. The newer term of remote sensing actually only expands the wavelength sensitivity of the sensor to vary from ultraviolet to microwaves. Nonmilitary applications of remote sensing are now extremely important in survey and surveillance of earth resources and environmental change. This document is designed to provide engineers an overview of the field of remote sensing. The discussion covers: The energy flow profile from source through target to sensor; film images; infrared scanners; passive microwave systems; and radar. Consideration is given to current trends in the utilization of remote sensing, and to the potential satellite systems such as ERTS-A.

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SAFETY

EVALUATION OF LEAD PAINT HAZARD ELIMINATION METHODS. PART 2.

National Bureau of Standards, Center for Building Technology. David Waksman, Leopold F. Skoda, Elizabeth J. Clark, and McClure Godettee. March 1973. 78 pages.

COM–73–10857

A major cause of lead poisoning in children is the ingestion of lead-containing paint from the walls, woodwork, and fixtures of dwelling units. Many factors should be considered in the selection of methods for the elimination of this hazard. In general, each dwelling should be treated as a separate entity due to the variations in architectural configuration, the structural condition of the unit, and the location of the hazard. This report considers the major procedures that should be considered when selecting a method for the elimination of the lead paint hazard. The attributes associated with each type of method are analyzed in terms of inaccessibility of the leaded paint and implementation precedures. This report is a continuation of PB-213 352, which is described in the July 1973 issue of AMTID, page 87.

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HAZARD ELIMINATION PROCEDURES FOR LEADED PAINTS IN HOUSING

National Bureau of Standards, Center for Building Technology. David Waksman, Leopold F. Skoda, and Elizabeth J. Clark. May 1973. 102 pages.

COM–73–50495

Childhood lead poisoning is a problem that has been facing health departments and building officials for many years. The magnitude of this problem, however, has only been recently realized. This form of poisoning in children results almost exclusively from ingestion of flaking and peeling lead-containing paints found in old houses and on old furniture. This publication is intended to meet the growing need for information about the various building materials and techniques that are currently available to make leaded paint in housing inaccessible to children. A series of guidelines is presented to help acquaint the reader with the factors that should be considered in implementing a hazard elimination program. Formats are presented to describe attributes of the various methods that should be considered.

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FIRE SERVICE LOCATION—ALLOCATION MODELS

National Bureau of Standards, Institute for Applied Technology. Donald Colner, and David Gilsinn. June 1973. 48 pages.

COM–73–50535

A necessary part of an objective approach to the location of fire services within an urban area is the consideration of where facilities should be located and a measurement of the level of service provided, as a function of the number of facilities and their current locations. This report is intended to provide operations researchers, mathematicians, planners and others with a perspective on analytical approaches to the fire station location problem. Brief summaries are given of three historic location-allocation studies. Next, consideration is given to what is to be located (facilities, companies, equipment, or men), and a terminology is provided for special characteristics to be used in the models. Several different types of location models are described, and methods of providing solutions to these models are discussed.

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WORKSHOP ON SCIENCE PLANNING AND POLICY IN THAILAND

National Research Council of Thailand; and U.S. National Academy of Sciences. July 1972. 47 pages.

PB–222 441

A group of scientists and engineers from Thailand and the U.S.A. engaged in a workshop, convened in Bangkok during July 1972, to consider the role of science and technology in relation to the development of Thailand. Particular emphasis was given to planning and implementing science policy in Thailand. This report summarizes the activities of that workshop. In addition, the findings and recommendations of the working groups in the following areas are given in full: Industry and engineering; natural resources and their utilization; agricultural production; medicine, public health, and environmental quality; academic science.

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WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH. VOLUME III.

Lembaga Ilmu Pengetahuan Indonesia; and U.S. National Academy of Sciences. January 1971. 119 pages.

PB–222 457

A workshop was held in Djakarta in January 1971 to formulate matters on industrial research in Indonesia and to make recommendations thereupon to the Indonesian government. This third volume of the report emerging from that workshop is comprised of supporting materials, including the texts of the various addresses given, and the Summary Report. Volume I, which contains the overall findings and recommendations of the workshop, is available as PB-217 118 ($3.00); Volume II, containing the results of the Plenary Sessions and Working Groups, is available as PB-218 724 ($3.00). Both of these are described in AMTID. July 1973, pages 141-142.

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U. S. INTERNATIONAL FIRMS AND R, D AND E IN DEVELOPING COUNTRIES

National Academy of Sciences, Office of the Foreign Secretary. 1973. 90 pages.

PB–222 787

International (or multinational) firms are currently receiving attention in many quarters and from many angles. Not least among the issues under study is their impact on developing countries as leading purveyors of private capital and technology. Some developing countries, believing themselves to be adversely affected by this flow of capital and technology, have introduced measures to bring it under tight control. Others ask whether they are taking maximum advantage of the unique capabilities and resources of the international firms to advance national development objectives. The debate engendered by these concerns has produced a climate of uncertainty and frustration with effects that may well be prejudicial to the interests of both the developing countries and the foreign investor communities. To set the stage for discussion, the report highlights some of the larger issues in contention; then it focuses on one aspect of the U.S. firm-developing country relationship: its potential for strengthening indigenous research, development, and engineering capabilities. Despite its lack of prominence thus far it is believed that this area could significantly help bridge the interests of the international firm and the host country. The report seeks to illuminate possibilities for mutually beneficial research, development, and engineering efforts, keeping in sight throughout the imperatives motivating the two sides; the developing countries' determination to achieve technological progress and a measure of self-reliance, and the international firm's requirement to operate at a profit. Many opportunities for constructive action are cited.

WORKSHOP ON THE ROLE OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH IN DETERMINING POLICY AND RESEARCH PRIORITIES

Council for Scientific and Industrial Research (Ghana); Universities of Ghana; and National Academy of Sciences (U.S.A.). May 1973. 64 pages.

PB–223 310

This document provides a report of the activities and recommendations of, and background information for, joint Ghana/U.S.A. workshop on Ghanaian science policy and research priorities, which was held at Accra 18-31 March 1973. The topics covered include: brief history of science organization in Ghana; the current state of science organization in Ghana, including a description of the organizational structure and functions of the Council for Scientific and Industrial Research; constraints which hinder the development of science and technology in Ghana; the science advisory mechanism; proposal for the creation of a new planning and analysis group, including its function, staffing, composition with regard to disciplinary background of members, personnel policies, guidelines for operations, nature and method of work, and potential operating problems; recommendations for the development of science and technology in Ghana; suggested areas for the assessment of research priorities.

SOCIAL SCIENCES AND LAW

THE DECLINE OF FERTILITY AND CHILD MORTALITY IN CENTRAL EAST PAKISTAN

Rand Corporation. T. Paul Schultz. June 1971. 28 pages.

AD–735 073

A major objective of demographic research is to develop analytical and empirical foundations for predicting future demographic trends in a reliable manner, thereby providing time for implementing policy to cope with the repercussions of these trends. An even more important role for research is to estimate the responsiveness of demographic trends to policy instruments, allowing governments the option to modify future trends. This study first explores the policy making needs for demographic information and research. It attempts, then, to estimate on an aggregate basis some of this information for East Pakistan from a survey of retrospective histories collected from a sample of married women. This investigation supports the conclusion that more attention should be turned to retrospective longitudinal surveys and their micro analysis.

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AN ECONOMIC PERSPECTIVE ON POPULATION GROWTH

Rand Corporation. T. Paul Schultz. July 1971. 53 pages.

AD–738 052

Rapid population growth is approached from a perspective of micro-analysis, which is from the standpoint of the family; its welfare and behavior. A microanalyst's approach to the population study seeks to show how additional population pressures arise and impinge on the welfare, goals, opportunities, and behavior of the family. An attempt is made to trace the effects of population growth and economic development on the allocation of family resources. This document develops a model of family reproductive behavior; identifies how economic development and the acceleration in population growth affect the family's environment; and infers from the framework what consequences are likely to follow from mounting population pressures.

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A FRAMEWORK FOR ANALYSIS AND ITS APPLICATION TO TAIWAN'S FAMILY PLANNING PROGRAM

Rand Corporation. T. Paul Schultz. July 1971. 71 pages.

AD–738 072

Evaluating the social contribution of population programs is a a difficult task. A variety of evaluation methods has developed, but this paper presents disconcerting evidence that different approaches can yield very different implications for improving policy. This investigation of the Taiwan family planning program explores these issues and develops tentative guidelines for the organization and evaluation of population programs. Alternative approaches to population policy evaluation are reviewed. In the context of Taiwan, an analytical approach to evaluation is developed and applied to confirm the effectiveness of field personnel in the Taiwan family planning program and to challenge early evidence on this program's optimal size and structure.

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THE EFFECTIVENESS OF POPULATION POLICIES: ALTERNATIVE METHODS OF STATISTICAL INFERENCE

Rand Corporation. T. Paul Schultz. July 1971. 48 pages.

AD–751 811

The paper explores the implications of alternative statistical models for evaluating the effects of family planning. The objective is to estimate these models with data for Taiwan to determine their practical usefulness. Simultaneous equations techniques are needed if one is to obtain a proper understanding of the effects of population policies on reproductive behavior.

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PUZZLES IN THE DEMOGRAPHIC AND ECONOMIC BEHAVIOR OF RURAL SOUTHEAST ASIANS: AN ECONOMIST'S VIEW

Rand Corporation. William P. Butz. December 1972. 14 pages.

AD–766 876

Anomalies in people's behavior may suggest important research questions in the social sciences. Thus several anomalies in the demographic and economic behavior of rural people in Southeast Asia have suggested sociological research. Five of these in particular involve behavior that departs from that considered characteristic of demographic response. The first is relaxation of taboos with economic change. Another is increase of investment in family networks. A third is adoption of modern consumer goods accompanied by disregard for modern producer goods. Still another is simultaneous increase and decrease in births among different poor groups. The fifth is household size maintenance through outmigration of older children rather than by birth control. Several hypotheses are offered, and suggestions are made concerning program research to test these hypotheses.

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A QUANTITATIVE ANALYSIS OF MODERNIZATION

Office of Research Analysis (USAF). Gary Buck. January 1969. 232 pages.

AD–867 201

Alterations in a social system, whether they involve social changes, modernization, industrialization, economic development, or other processes which are manifestations of the same process, remain among the least developed of all the areas of social science. Cultural evolution itself is only a concept for a quest for regularities or laws amid adaptation and complexity. The report presents an analysis of a neo-evolutionary theory of social change. Certain variables of the social system are identified, the order of development of the state-variables is specified, and the theoretical statement is tested. The theory derives from a conceptualization in which organizational developments of sufficient importance to further evolution are measured statistically. The report considers whether empirical support exists for Talcott Parsons' evolutionary universals, as modified. It groups nations by level of development and geographic region. The major technique used is scalogram analysis. The universals are communications, kinship, religion, technology, stratification, cultural authority, bureaucracy, money and marketing, democratic association, and universal norms.

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INDEX TO MARINE TREATIES

University of Washington, Division of Marine Resources. John King Gamble, Jr. June 1972. 441 pages.

COM–72–11467

The index was developed in response to the proliferation of marine matters being dealt with by treaties, creating a need for an efficient way to locate detailed treaty data. It includes most of the world's marine treaties and virtually all marine treaties to which the United States or Canada are party. "Marine" is defined as including information on fisheries and fishing, oceans and ocean resources, ocean and river frontier waters, noncommerce and trade navigation, and water vessel operation. About 400 treaties are included. The index is divided into three sections, each of which contains the same information arranged in different ways: One is by alphabetical order, the next is by treaty number and alphabetical array, and the third is divided into broad topical areas such as boundaries, commissions, etc.

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THE SURGE OF SEA LAW

University of North Carolina, Law School. Seymour W. Wurfel. March 1973. 252 pages.

COM–73–10778

Legal control of the marine environment is a matter of serious present day concern, leading to a recent surge of sea law that has confused both laymen and marine scientists. At the same time the situation calls for action by legislators, scientists, lawyers, and the public to establish effective marine resource conservation mechanisms, nationally and internationally. The document is comprised of papers researched and written by students of international law. Some of the topics included relate to freedom of the seas, tunaboat seizures, jurisdiction in national waters, international seabed control, delimitation of territorial seas, ocean environment control, toxic substance and radioactive waste disposal, maritime oil spills, marine mammal and fish conservation, offshore oil drilling, legal problems, personal injury and death in maritime surroundings, and foreign flag operations.

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THE LATIN AMERICAN APPROACH TO THE LAW OF THE SEA

University of North Carolina, Law School. Jan H. Samet, and Robert L. Fuerst. March 1973. 169 pages.

COM–73–11198

This document provides a detailed review and analysis of the positions of the Latin American countries regarding the law of the sea. Much of the material has not previously been readily available. Consideration is given to the philosophy and historical development of Latin American claims to two-hundred mile territorial waters; the specific individual views and laws of most of these nations regarding the exercise of jurisdiction in the "patrimonial sea" areas contiguous to their coasts; and a detailed examination of national statutes dealing with the exploration and exploitation of off-shore mineral and living marine resources. The report concludes with an evaluation of the Latin American legal thought and action upon the evolving law of the sea.

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DICTIONARY OF ECONOMIC AND STATISTICAL TERMS

U.S. Department of Commerce, Social and Economic Statistics Administration. November 1972. 84 pages.

COM–73 50105

Terminology is a major factor, and frequently a source of confusion, in the utilization of economic and social statistics as presented in publications, press releases, and computer tapes. To provide a guide and reference, the dictionary has been compiled, enlarged, and revised with particular direction toward the nontechnical user. The contents are arranged under national income and product accounts; balance of payments accounts involving merchandise, services, private and government capital, and monetary gold; economic and statistical indicators—concepts and terms used in analyzing current economic data and population data; demographic and social terms—selected concepts and expressions used in collecting, analyzing, and publishing data on the population and its characteristics; and economic and statistical terms of particular importance.

TECHNOLOGY TRANSFER

TECHNOLOGY ASSESSMENT AND FORECAST

U.S. Department of Commerce, Office of Technology Assessment and Forecast. May 1973. 61 pages.

COM–73–10767

Economic strength and national security in the modern world rest predominantly on a technological foundation. To meet the challenges of economic productivity and international competition, technological resources must be utilized effectively, and thus the availability of information becomes a key factor in decision making. The report deals with a United States program of information availability that draws on a data base from the Patent Office file of more than 11 million U.S. patent documents, an excellent source of technological information. Each year approximately 250,000 documents are added, and as new technologies develop, the entire file is updated. The document contains a sampling of the types of data and formats that will be provided in future reports. Activity of foreign origin is identified. Twenty four areas are analyzed, including magnetohydrodynamic generation of electricity, electronically actuated fuel injectors, inorganic fluorescent compositions, crimped fibers, pipe and cable laying, metal shaping, and others. Considerable data are presented in graphic form.

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AID/NASA PILOT PROJECT FOR TECHNOLOGY TRANSFER TO A DEVELOPING NATION–REPUBLIC OF KOREA

Korea Institute of Science and Technology. San Joon Hahn, Man Yung Chung, Young Ku Yoon, *et al.* June 1972. 191 pages.

PB–222 557

Technological advancement and industrial expansion are vital factors in the socio-economic growth of any nation. In a developing nation, contact with foreign technology is especially important because the nation depends on the emergence and introduction of new industries and improved technologies to foster a rapid, but orderly, economic growth. The program described in this report was a pilot study designed to determine the feasibility of and to establish refined techniques for the transfer of aerospace-developed technology to developing nations. The primary participants in the program were the Korea Institute of Science and Technology and the IIT Research Institute of the U.S.A. The goals of the program were: Train Korean personnel in the techniques of technology transfer and the utilization of technology resources; evolve and implement modified transfer techniques applicable to Korea; achieve specific transfers of aerospace-developed technology in areas of potential economic advantage; develop a revised training and implementation plan based on success and failures; and evaluate the techniques in terms of applicability to developing nations in general. This report presents an evaluation of the pilot project from the viewpoint of the Korean participants. Therefore, it emphasizes those phases in which they were directly involved: training and technology transfer. For an evaluation from the viewpoint of the U.S. participants, see PB-222 584 below.

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TECHNOLOGY TRANSFER TO A DEVELOPING NATION. A REPORT OF THE AID/NASA PILOT PROJECT TO THE REPUBLIC OF KOREA

IIT Research Institute. C. A. Stone, and S. J. Uccetta. 1973. 90 pages.

PB–222 584

An experimental project has been undertaken to determine if selected types of technology developed for the U.S. aerospace program are relevant to specific industrial problems of a developing nation, and to test whether a structured program could facilitate the transfer of relevant technologies. The Korea Institute of Science and Technology, and the IIT Research Institute functioned as the active transfer agents in the program. This report reviews the technology transfer methodology which was initiated, along with the evolutionary changes which took place as the project progressed. The project implementation and accomplishments are detailed with discussions of each transfer activity. While there was a unifying technical theme, the electronics industry, each transfer attempt provided different learnings and accomplishments. The report presents a retrospective critique of the pilot project and attempts to relate these findings to other developing countries, although it is recognized that each country will have requirements peculiar to its needs and capabilities. The impacts (real and potential) which have accrued as a result of the pilot project are summarized, together with the key learnings that have been achieved. Efforts, past and future, to disseminate the results of the project are briefly reviewed in the context of possible adaption of the same or similar technology transfer activities by other countries. Finally, recommendations for related technology transfer activities are made. (Also see PB-222 557, above).

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PROCEEDINGS OF THE INTERNATIONAL SEMINAR ON DISSEMINATION OF TECHNOLOGY. NOVEMBER 20-22, 1972. SEOUL, KOREA

Korea Institute of Science and Technology; IIT Research Institute; and Agency for International Development. November 1972. 164 pages.

PB–222 954

This document is comprised of papers which were presented at a seminar which was organized for the purposes of (1) sharing among developing countries the experiences of the Korea Institute of Science and Technology and the IIT Research Institute gained during an experimental technology transfer program conducted by the two organizations; and (2) providing a forum for an exchange of views among the participants who represented the industries, research institutions, and governments of India, Indonesia, Korea, Malaysia, Pakistan, the Philippines, Thailand, and the United States. The subject matter covered includes: A problem oriented approach to technology transfer to a developing nation; experience of the East-West Technology and Development Institute (Honolulu) in promoting institutional cooperation in adaptive technology; observations and learnings in technology transfer to developing industries; the Indian experience in technology dissemination; a proposed technology transfer solution for Indonesia; some problems and technology transfer needs of Malaysia; present status of industrialization and science and technology in Pakistan and future requirements for effective utilization of advanced technology; technology and research for national progress; industrial research activities in Thailand; problems of technology transfer and needs of India; role of the Indonesia Building Research Institute in the building materials industry; transfer and utilization of advanced technology in Malaysia; transfer and utilization of technology in the manufacturing industry in Thailand; technologic needs of developing countries like the Philippines; U.S. technology information resources; recent programs related to technology transfer; fluorocarbon pilot plant construction at KIST—a case study; role of KIST in the introduction of foreign technology to metal products manufacturing; the Organization of American States' pilot project for transfer of technology; technology transfer in the Asian region.

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TRANSPORTATION

TECHNOLOGICAL FORECAST: 1975-2000–A DESCRIPTIVE OUTLOOK AND METHOD FOR QUANTITATIVE PREDICTION

U.S. Department of Transportation, Office of Systems Requirements, Plans, and Information. E. I. Golding, W. D. Velona, and B. Poole. May 1970. 360 pages.

AD–754 178

The report is concerned with developments and feasible concepts in transportation technology which may offer opportunities for improving the movement of goods and persons, and with methodology to identify the relative value and levels of investment in research-development for each new system, measured by impact on both transport and the environment. The documented research has focused on identification of technological trends, describing new concepts and operating characteristics, predicting research and development costs and time requirements for new systems, and developing a methodology for predicting the modal choice of passengers during a forecast period of 25 years. The results of a Delphi forecasting exercise are given, and a description is provided of the parameters used to define each system used in the modal split.

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TRANSPORTATION SYSTEMS TECHNOLOGY: A TWENTY-YEAR OUTLOOK

Transportation Systems Center. George Kovatch, John B. Barber, Robert F. Casey, and George Zames. August 1971. 195 pages.

PB–213 012

The report documents the findings of a technology survey of various new transportation systems, an analysis of associated critical questions, and a forecast of possible developments. The form is non-technical; the coverage is of passengers and freight in urban and interurban context. The new modes are sought to provide alternatives to the automobile in congested urban areas, to reduce automobile air pollution, to increase the efficiency of people movement during peak hours, to improve high speed intercity traffic, to improve the efficiency of intercity and urban cargo transport, and to increase the efficiency and safety of air travel in interurban long hauls. No attempt is made to give full cost analysis or to analyze competing systems. The passenger systems discussed are personalized rapid transit, guideway, dual mode, dial-a-ride, public automobile, high-speed rail, tracked air cushion, and magnetic suspension. Freight systems include rail, highway, pipeline, marine, intermodal, and containerized. Technologies discussed include low pollution vehicles, propulsion, power, braking, suspension, support, tunneling, and control systems. Wide scale applications are limited to the next two decades, and some recommendations are given.

FORECAST TECHNOLOGICAL PROBABILITIES

Northrup Airport Development Corporation. December 1971. 273 pages.

PB–215 888

This document provides as assessment of the state-of-the-art and an estimate of technological probabilities for the time period 1975-2000 in the aviation subsystem elements and the surface transportation modes which affect and are affected by airport facilities. The purpose is to provide a basis for developing aviation policy targets, and for evaluating and planning future aviation systems concepts. The aviation subsystem elements considered include: Air vehicles (reduced- and short-take-off-and-landing aircraft, vertical-take-off-and-landing aircraft, supersonic and hypersonic transport aircraft, private transport aircraft); airports (pavements, restraining devices, lighting, visual aids, fuel systems, terminals terminal-to-aircraft transportation, utilities, loading and unloading systems, towing and hauling, environmental compatibility); airways (enroute navigation, terminal navigation, landing aids, air traffic control); group access (tracked rolling systems, aerial suspension systems, local highway systems, tracked levitated systems, tube vehicles). Consideration is also given to interfaces between the aviation subsystem components, and to developments competitive with air transportation.

DEVELOPMENT OF URBAN PUBLIC TRANSPORTATION SYSTEM STANDARDS AND PROJECT EVALUATION CRITERIA

Michigan Bureau of Transportation. Dietrich R. Bergmann. May 1972. 101 pages.

PB–216 164

The report deals with the several purposes of public transportation services in a modern urban environment, and an assessment of the associated structure of benefits to the public. It recommends procedures for the development of standards and priorities for resource allocation. Involved are the identification of both tangible and intangible benefits and a comparison with the costs required to achieve them. One idea is that rigidly defining levels of public transportation according to the particular community sizes is inappropriate—that service standards must be derived for a given community only after thorough examination of what the service can accomplish in that community. Of high importance is choice making between technological alternatives and policy alternatives. The author presents seven distinct purposes for urban public transportation services and develops a microscopic approach for their measurement. Forms and costs are reviewed, particularly the sensitivity of manpower costs to changes. Socioeconomic factors affecting patronage are noted, followed by the development of service standards for an entire urban area. Two case studies are included.

WASTE PROCESSING AND MATERIALS RECOVERY

EFFECTIVE DRY METHODS OF SEPARATING THERMOPLASTIC FILMS FROM WASTEPAPERS

U.S. Department of Agriculture, Forest Products Laboratory. J. F. Laundrie, and J. H. Klungness. 1973. 13 pages.

AD–759 497

One of the technical difficulties involved in efforts to recycle paper has been the difficulty in separating the paper component from plastic film material which often accompanies it in waste mixtures. This document describes two effective methods for separating these fractions. One method utilizes the tendency of heated thermoplastic films to adhere to a heated surface. The other method consists of suspending the mixtures of thermoplastic film and wastepaper in a hot gas to contract the films upon themselves, followed by air classification and/or screening. Both methods are practical, and the latter can be used immediately with equipment currently on the market.

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DEVELOPMENT OF AQUEOUS PROCESSES FOR REMOVING NO$_x$ FROM FLUE GASES

Esso Research and Engineering Company, Government Research Laboratory. Gilford A. Chappell. September 1972. 212 pages.

PB–212 858

The oxides of nitrogen, NO and NO_2, are essential components in the formation of photochemical smog in addition to being pollutants in their own right. Large fossil fuel fired boilers, such as those found in electric power generating plants, are major sources of these oxides. A promising method for removing oxides of nitrogen (NO_x) from flue gases involves the aqueous scrubbing of the flue gas. This report gives the results of a study which was undertaken to evaluate the capability of various aqueous solutions to absorb NO_x from flue gases. The following scrubbing media were investigated: water; metal hydroxides and slurries; ammonia and 2-aminoethanol solutions; acid solutions; and salt solutions. Several systems were identified which appear useful with a high degree of flexibility available in their application.

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RESOURCE RECOVERY: CATALOGUE OF PROCESSES

Midwest Research Institute. W. E. Franklin, D. Bendersky, L. J. Shanon, and W. R. Park. February 1973. 151 pages.

PB–214 148

Increasing research is being devoted to the recovery of resources from municipal solid wastes, spurred by the economic success of new technologies. The report reviews a number of these processes, under five headings, by which mixed urban solid wastes are converted into usable substances. The first is energy recovery, producing fuels, steam for electricity generation, and useful materials. Next is materials recovery, yielding glass, magnetic metals, aluminum, zinc, pulp, fibers, and others. The third is pyrolysis or destructive distillation by which fuels, gas, slag, tar, char, and similar materials are obtained. Composting by bacterial action produces humus, hydrocarbon gases, ferrous metals, and fiber. By chemical action cellulose is converted into starch or sugar-like compounds, protein, and cattle feed, and sludge produces soil conditioners, oils, fats, humus, and methane. Technical, economic, and general information are given for each process when available, and some attention is given to the economics of recycling.

RESOURCE RECOVERY: THE STATE OF TECHNOLOGY

Midwest Research Institute. W. E. Franklin, D. Bendersky, L. J. Shanon, and W. R. Park. February 1973. 70 pages.

PB–214 149

A marked increase is occurring in the development of new technology for recovery of resources from municipal waste. Of the two conventional methods in use, the first—incineration—has been subject to boiler erosion and corrosion and questionable reliability of delivery, while the other—composting—has been poor in marketability of the finished product. The report discusses several emerging technological processes: energy recovery, materials recovery, pyrolysis, and chemical conversion; and it reviews all processes, old and new. These include mixed urban refuse as fuels to substitute for conventional fuels in power plants; high pressure combustion to drive a turbine electric generator; steam and frit production by high temperature incineration; paper pulp reclamation by wet processing of mixed municipal solid waste; conventional methods of shredding, screening, grinding, and magnetic separation of incinerator residues; destructive distillation of organic waste portions under absence or control of oxygen; and composting improvements. The economic feasibility of the several systems is also considered.

BIBLIOGRAPHY OF LIVESTOCK WASTE MANAGEMENT

Iowa State University, Agricultural Engineering Department. J. Ronald Miner, Dwaine Bundy, and Gerald Christenbury. December 1972. 150 pages.

PB–214 410

In keeping with today's concern over air and water pollution in both urban and rural environments, one matter which is receiving serious attention is animal waste disposal. Specific sources of waste under scrutiny are those from beef cattle, swine, poultry, dairy cattle, sheep, and other animals of economic importance, whether being raised in roofed or unroofed systems. Areas of interest are water pollution or odors resulting from the wastes, their characteristics, storage, transport, treatment, utilization and disposal, with particular reference to animal manures. The objective leading to the report was to compile a current abstract series of literature relating to animal waste disposal and pollution control. The resulting bibliography contains journal articles, conference proceedings, government publications, books, magazine articles, and research theses. Any one of the items may be identified and located from the author's name, the title of the article, or the subject matter listing.

PLANNING, DEVELOPMENT AND MANAGEMENT OF WASTEWATER TREATMENT FACILITIES. TRAINING MANUAL

Environmental Protection Agency, Office of Water Programs. July 1971. 268 pages.

PB–214 516

The intent of this manual is to provide a fund of the best available current information pertinent to the subject of wastewater treatment facilities. It should be useful to anyone who has a need for information on this subject. Some of the topics covered are: Area wastewater treatment options; effluent and stream standards; conventional treatment overview; wastewater treatment schematics, functions, and options; fundamentals of activated sludge waste treatment; activated sludge treatment process variations and options; physical-chemical treatment overview; fundamentals of trickling filter waste treatment; design of trickling filter systems; experience in the use of sewage lagoons; status of advanced waste treatment; small scale waste treatment systems; interceptors, pumping stations, outfalls; screening; grit rmoval; pumps and controls; flow measurement devices; sedimentation basins; sediment tank equipment; practical aspects of oxygen transfer; process equipment for sludge handling, digestion, and disposal; basic principles of vacuum filtration; sludge combustion; process instrumentation; ultimate disposal to the environment; disinfectation; training for wastewater treatment plant operators; plant safety practices; laboratory examination; plant maintenance; pump maintenance; methods for achieving high BOD and solids removal from conventional plants; review of plans and specifications; plant performance evaluation; design guidelines; glossary of wastewater treatment terms.

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PHYSICAL-CHEMICAL TREATMENT TECHNOLOGY

Environmental Protection Agency, Office of Water Programs. January 1972. 158 pages.

PB–214 517

Physical and chemical treatment operations have been an integral part of wastewater renovation since treatment began. Various operations have been used for initial and terminal cleanup, as well as within process of natural or engineered systems. This document is primarily intended as a training manual for professional and technical personnel concerned with the selection, design, operation, and evaluation of physical and chemical procedures for water pollution control and wastewater renovation. It will also be useful to anyone who has need for information on the subjects covered. The general topics covered include: thermal pollution; separation of solids from liquids; other unit operations or processes, such as chemical oxidation, ammonia removal, and neutralization; dewatering and disposal.

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EVALUATION OF WASTE WATERS FROM PETROLEUM AND COAL PROCESSING

University of Oklahoma, School of Environmental Science. George W. Reid, Leale E. Streebin, David W. Rumfeldt, and Robert Sweasy. December 1972. 217 pages.

PB–214 610

Most oil-bearing strata have brine formations over or under them. In spite of brine control, the brine is frequently pumped out with the oil and must be separated and disposed of. Since the salt concentration is tremendously high, pollution of the regional surface waters must be prevented. Other potential pollutants are spilled or leaked oil, drilling muds, tank bottom sludges, natural gas, and acid waters, but brine presents the big difficulty. The report presents an evaluation of pollution problems, abatement procedures, and control techniques. Petroleum wastes are discussed under three broad sections: Drilling and production, transportation and storage, and refining; in each of these wastes are identified and treatment methods are discussed. The results of a field study are reported, providing information on the characteristics of waste streams from individual processes within the refinery. Coal mining, processing, and utilization, the wastes associated with each, and corresponding control measures are discussed. The phenols, ammonia, and dissolved organics produced in coke production, and their treatment are examined. Waste characteristics and treatment efficiencies are tabulated, and some treatment diagrams are presented.

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METHODS OF PREDICTING SOLID WASTE CHARACTERISTICS

URS Research Company. Gail B. Boyd and Myron B. Hawkins. 1971. 33 pages.

PB–214 760

An intimate knowledge of the composition of waste is needed as a basis for the design of waste management systems and for the planning of research and development for solid waste-handling and treatment processes. This document describes the design of a model for estimating and predicting the quantity and composition of solid waste generated by a community, and a test of the feasibility of the model. The concept employed is novel in that it is based on knowledge of materials and quantities before they become a part of the solid waste stream, together with an understanding of the process by which the materials become solid waste. The method is shown to be feasible, thus offering a potential solution to the hitherto intractable problem of estimating and predicting solid waste composition and quantity on a community wide basis.

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USE OF CRYOGENS TO RECLAIM NONFERROUS SCRAP METALS

Bureau of Mines, Salt Lake City Metallurgy Research Center. Espiridion G. Valdez, Karl C. Dean, and Wayne J. Wilson. 1973. 18 pages.

PB–214 786

Scrap such as insulated copper wire, small motors, and nonferrous automobile scrap contains materials that become brittle at low temperatures and other materials that remain malleable. This report gives the results of studies that involved crushing of the chilled materials to shatter the embrittled portion followed by magnetic separation, screening, and/or gravity separation. The temperatures studied varied from –30 to –195 C and were varied to suit the type of material studied. A sufficiently low temperature could be obtained by indirect chilling using a liquid CO_2— dry ice system to satisfactorily process insulated wires and mixed nonferrous metallic concentrates. In the case of copper wire insulated with polyvinyl chloride and neoprene, chilling, roll-crushing, and water elutriation yielded product fractions that were 99% metallic and 99% nonmetallic, respectively. Excellent separation of zinc die-casting alloys from copper and aluminum in automotive nonferrous scrap was achieved by chilling, crushing in a hammermill, and screening.

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DISPOSAL OF BRINE EFFLUENTS

Dow Chemical Company. R. R. Grinstead, and T. E. Lingafelter. August 1972. 126 pages.

PB–215 037

The production of fresh water from saline sources involves the simultaneous production of a variable volume (depending on the process) of concentrated brine. Disposal of this brine at ocean sites is usually not a major problem, but for desalination plants located at inland sites the disposal problem can be serious and complex. This document describes a process by which brines from the desalination of brackish water supplies can be converted to either useful products or to waste materials which can be disposed of without environmental harm. The various components of the brine are converted as follows: calcium and magnesium to calcium carbonate and magnesium oxide (waste); sulfate to calcium sulfate (waste); sodium and bicarbonate to sodium carbonate (product); and chloride to calcium chloride (product, part of which is recycled in the process). The process would be competitive with conventional disposal methods (solar ponds or wells) at a production level slightly greater than 5 mgd of water and would be most attractive in cases where there is a high sodium carbonate requirement for pretreatment.

PROCEEDINGS: FIRST NATIONAL CONFERENCE ON PACKAGING WASTES

Enviromnental Protection Agency, Solid Waste Management; and University of California at Davis. 1971. 241 pages.

PB–215 328

This document is comprised of papers presented at a conference, held in September 1969, which was organized for the purpose of generating ideas for and approaches to the solution of packaging waste problems. The conference program focused attention especially on defining and clarifying the many problems related to the accumulation and disposal of packaging wastes generated by the dual forces of an exploding population and marketing trends which have led to a wide variety of packages which are increasing made up of materials that won't burn, break, crush, degrade, or dissolve. Some of the topics covered by the papers are: packaging problems from the points of view of the package user, the municipal waste management official, and the concerned citizen; developing strategies for packaging waste management; technical problems associated with wastes from paper and paperboard packages; waste from metal packages; wastes from plastic packages; role of glass containers in solid waste disposal; motivating the packaging industry with respect to the disposal problem; improving package disposability; incineration of packaging wastes with minimal air pollution; future research needs and goals.

PROCEEDINGS, SECOND NATIONAL SYMPOSIUM ON FOOD PROCESSING WASTES

Environmental Protection Agency, Pacific Northwest Water Laboratory; and National Canners Association. 1971. 654 pages.

PB–215 517

This document is comprised of papers presented at a symposium, held in Denver, Colorado during March 1971, on the treatment of wastes from the food processing industry. The topics covered include: Activities in managing solid wastes; pollution abatement and by-product recovery in the shellfish industry; salt reclamation from food processing brines; reduction of salt content of food processing liquid waste effluent; production and disposal practices for liquid wastes from canning and freezing fruits and vegetables; dry caustic vs. conventional caustic peeling and the effect on waste disposal; production of potato starch without waste; alternative methods for processing potato starch plant effluents; continuous treatment of corn and pea processing waste water with *Fungi imperfecti;* cannery waste treatment by lagoons and oxidation ditch; biological treatment of citrus processing wastewaters; treatment of meat packing waste using PVC trickling filters; dehydration of cattle rumen and dried blood; water and waste management in poultry processing; removal and recovery of fatty materials from edible oil and fat refinery effluents; biological treatment of yeast wastes; membrane processing of cottage cheese whey; activated sludge and trickling filter treatment of whey effluents; methane fermentation of whey; state of the art of dairy food plant wastes and waste treatment; anaerobic-aerobic ponds for treatment of beet sugar wastes; state-of-art sugarbeet processing waste treatment; principles of nutrient control for agricultural wastewaters; oxidation ditch treatment of meat packing wastes; solid waste management in the food processing industry. The proceedings of the first symposium in this series are available as PB–199 709 for $3.00 (see AMTID, January 1971, page 8); the proceedings of the third symposium are available as PB–214 418 for $5.25 (see AMTID, July 1973, page 15).

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AN INVESTIGATION OF TECHNIQUES FOR REMOVAL OF CHROMIUM FROM ELECTROPLATING WASTES

Battelle Memorial Institute, Columbus Laboratories. G. R. Smithson, Jr. March 1971. 98 pages.

PB–215 694

Electroplating and metal-finishing waste streams can contribute to the pollution of natural waters either directly, owing to their content of toxic and corrosive materials; or indirectly, owing to the deleterious effect these compounds exert on biological sewage treatment systems. There is ample technology available for treating chromium-containing wastewaters to any required degree of detoxification. The conventional treatment methods, however, have been developed primarily for large electroplating plants where the relatively high cost of treatment can be absorbed. In an effort to develop an economical treatment for wastes from relatively small electroplating plants, several nonconventional methods were examined. These included activated-carbon adsorption, ion flotation, and solvent extraction. From a practical standpoint, the activated-carbon process was found to excel in the treatment of chromium rinse waters from small plating shops. The carbon process may have significant advantages in low capital investment, simple and continuous operation, and minimum floor space requirements.

CYCLING AND CONTROL OF METALS

National Environmental Research Center. Marion G. Curry and Gilbert M. Gigliotti. February 1973. 196 pages.

PB–216 184

The volume is based on a 1972 conference in Columbus, Ohio, dealing with the problems of metals in relation to the environment, particularly the trace metals. In five sessions matters were presented on sources, transport, control processes, monitoring, and the economic and legal aspects of pollution. Among the topics discussed were the lead industry as a source of trace metals in the environment, waste water discharges, natural marine sediments, and ocean dumping. Statistical data were given on refinery wastes, industrial chemical wastes, refuse and garbage, aerial fallout and rainfall washout. Other subjects were the biological uptake and distribution of lead in animals, control and prevention of mine drainage, significant effects of pollutants, criteria for metals in foods, lead emissions from automobiles, trace elements from fossil fuels, and specific common metals such as iron and mercury. The question of metal recycling received attention as well.

CONTROL TECHNIQUES FOR ASBESTOS AIR POLLUTANTS

Environmental Protection Agency, Office of Air Quality Planning and Standards. February 1973. 104 pages.

PB–222 020

Asbestos is the generic name for a group of naturally occurring, hydrated, mineral silicates. It can be separated into fibers and further subdivided into even smaller fibrils, as small as 0.03 micrometer, which may contribute to particulate air pollution. This document provides information which should be useful to those involved with the control of emissions of asbestos from industrial sources. The topics covered include: Background information on the properties, origins, and uses of asbestos; characterization of emission forms; major sources of asbestos emissions; control techniques during the mining of asbestos ores, milling of asbestos ores, manufacture of products containing asbestos, end uses of products containing asbestos, and disposal of asbestos waste; costs of control by gas cleaning devices; evaluation of asbestos emissions; development of new technology; and descriptions of three gas cleaning devices (fabric filters, dry centrifugal collectors, and wet collectors).

RECOVERY OF ZINC, COPPER, SILVER, AND IRON FROM ZINC SMELTER RESIDUE

Bureau of Mines, Rolla Metallurgy Research Center. H. E. Powell, and L. W. Higley. 1973. 18 pages.

PB–221 913

Primary smelting of zinc in horizontal retort distillation furnaces leaves a residue consisting of the following: unburned carbon, iron as metal shot and stringers, copper inclusions in the iron as metal and as sulfides, silver in solid solution in the copper, and glassy slag. This report describes two technologically feasible methods for recovering essentially all of the zinc, copper, silver, and iron contained in the magnetic fraction of this residue. A reduction smelting method permits recovery of virtually all of the silver; part of the copper, and a small amount of iron as a matte; plus a high-copper iron alloy. A matte smelting method produces a matte containing all of the silver, about 80% of the copper, and 37% of the iron; a coproduct is an iron-copper alloy containing all of the remaining iron and copper. By either method, essentially all of the zinc is recovered as the oxide.

WATER SUPPLIES AND HYDROLOGY

SPECIAL ANALYTIC STUDY OF METHODS FOR ESTUARINE WATER RESOURCES PLANNING

U.S. Army Corps of Engineers, Committee on Tidal Hydraulics. Allan Schmid. March 1969. 94 pages.

AD–756 160

This report concerns the methodology and application of four approaches to the investigation of water control and utilization in estuaries. The approaches are: (1) conventional methods of analysis (study of field data, simple hydraulic computations, *etc.*); (2) computer models; (3) analogues; and (4) hydraulic models. The types of problems that must usually be solved and the four analytical approaches, including the state of the art and the capabilities of each, are described. A number of case studies are included. The items that must be considered in various types of investigations are enumerated, and the relative competence of the several analysis methods, and combinations thereof, for the study of each item is given.

* * *

SELECTIVE WITHDRAWAL CHARACTERISTICS OF WEIRS

U.S. Army Engineers Waterways Experiment Station. J. L. Grace, Jr. June 1971. 36 pages.

AD–756 211

Effective planning, design, management, and operation of one or more man-made lakes for optimum conservation and utilization of regional water and related resources for many purposes involve, among others, the problems of predicting, monitoring, and controlling the thermal and chemical quality of impounded waters and releases through spillways, power-houses, and outlet works. Evaluation of the effectiveness of various structures in selectively withdrawing releases from various levels of stratified man-made lakes is urgently needed relative to multipurpose projects in which specific thermal and chemical requirements of the releases are desired, based on existing and future needs. The desire to release quality water requires monitoring the characteristics of water within lakes and knowledege of the flow pattern to be expected in the immediate and upstream vicinity of various regulating structures. A study was undertaken to determine the characteristics of withdrawal zones resulting from release of flows from randomly stratified lakes over weirs for developing means of predicting and controlling the quality of water discharged through downstream, fixed-level regulating structures. Generalized expressions describing the limits of the zone of withdrawal and distribution of velocities therein were developed from analyses of velocity and density distribution data. Means for evaluating those conditions where the free surface and/or bottom boundary dictates the upper and/or lower limits of the withdrawal zones were also determined. With the capability of predicting the velocity distribution to be anticipated for any given density distribution upstream of a weir, the weighted average technique can be applied to predict the value of any water-quality parameter of the outflow for which a profile in the lake is known.

HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT. VOLUME 1. REQUIREMENTS AND GENERAL PROCEDURES

U. S. Army Corps of Engineers, Hydrologic Engineering Center. L. R. Beard, A. J. Fredrich, and E. F. Hawkins. October 1971. 582 pages.

AD–758 904

This volume is one of a projected series which is intended to respond to the need throughout the world for hydrologic engineering methods that can be applied in regions of sparse data. It describes the general nature of water resource improvements and the general procedure used in hydrologic engineering studies. The topics covered include: local flood protection; flood control by reservoirs; water supply by reservoirs; hydroelectric power development; multipurpose reservoirs; water resource systems.

HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT. VOLUME 2. HYDROLOGIC DATA MANAGEMENT

U. S. Army Corps of Engineers, Hydraulic Engineering Center. Leo R. Beard. April 1972. 221 pages.

AD–758 905

The processing of basic hydrologic data includes the assembly of basic observational data and the preparation of such data for use in engineering analysis. In many developing countries, existing basic data are retained at the headquarters location for the area where the data are observed. Often there is no central agency that collects and prepares the data for easy use and dissemination. Use of existing data would be greatly facilitated if a system for collecting and organizing the field data was created. Another important requirement is that the observations be obtained in a systematic manner and tabulated at an acceptable regular interval.

This volume describes methods and procedures for managing hydrologic data in a systematic manner, techniques for estimating missing portions of hydrologic records, and techniques for generating synthetic hydrologic data. Consideration is given to data storage and publication, adjustment of runoff data, regional analysis, and hydrologic simulation. Included is a generalized computer program which will analyze monthly hydrologic data at a number of interrelated stations, generate sequences of hypothetical hydrologic data, and reconstruct missing hydrologic data on the basis of concurrent data observed at other locations.

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HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT. VOLUME 10. PRINCIPLES OF GROUND-WATER HYDROLOGY.

U. S. Army Corps of Engineers, Hydrologic Engineering Center. Richard L. Cooley, John F. Harsh, and David C. Lewis. April 1972. 353 pages.

AD–758 906

This volume provides a review of the fundamental concepts which govern the occurrence and movement of ground water. Its purpose is to present the basic principles of hydrology, geology, hydraulics, and physics as they relate to ground water. The information presented is sufficient to guide hydrologic engineers in the identification and initial considerations of ground-water aspects of water resources development studies. Some of the specific topics covered include: geology related to surface and subsurface water movement; effects of stratigraphy and sedimentation on ground-water occurrence and movement; theory of ground-water; flow nets; ground-water levels and fluctuations; flow to wells; surface investigation of ground water; subsurface investigation of ground water; occurrence of ground water in igneous and metamorphic rocks; occurrence of ground water in sedimentary rocks; occurrence of ground water in unconsolidated earth materials.

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APPLICATIONS OF SYSTEMS ANALYSIS TECHNIQUES TO WATER RESOURCES

Environmental Dynamics Incorporated. John A. Dracup, Vikram S. Budhraja, and Sharon G. Grant. June 1972. 271 pages.

PB–214 518

Optimum allocation of limited water resources among competing activities has long been a problem calling for systemetized planning. Current realization that there may now be mathematical techniques which may be applied has led to an intensive effort by researchers to utilize these techniques in systems analysis of water supply. The primary emphasis of the report is a critical review and assessment of recent literature in this area. All major publications from leading journals and reports from agencies and consulting companies have been considered. Problems within each area of water resource systems are defined and the available research within each problem area is discussed. The utility of simulation, linear and nonlinear programming, and dynamic and integer programming for solution of specific problems is noted, and recommendations are made. The study concentrates on actual applications—examples of where systems analysis has actually been utilized. Discussions include hydrologic systems, surface water, ground water, desalination, water quality, ecology, and economic-political-legal-social-institutional factors. Research priorities are also suggested.

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ANALYZING ORGANIZATIONAL CONFLICTS IN WATER RESOURCE MANAGEMENT: A SYSTEMATIC APPROACH

Analytic Sciences Corporation. Robert J. Martel and Dennis McLaughlin. September 1972. 125 pages.

PB–214 540

Water resources planning has been changed from a practice of approach and implementation by a small number of specialists without serious disapproval to a condition in which environmental discussions, opposition by interest groups, and challenges by citizens must all be taken into account. As a result of the social-economic-political factors which interact and often conflict, it becomes imperative to develop planning models which can serve to resolve controversy. The report presents a systematic treatment to analyze conflicts between planning agencies and public groups over water and related land use alternatives. The methodology consists of building dynamic system models of the institutional and economic factors involved in a water resources conflict, and then using the models to make quantitative and qualitative predictions of the course of events. Goals, constraints, strategies, and interactions are represented by dynamic feedback models.

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GROUND WATER RECHARGE AS AFFECTED BY SURFACE VEGETATION AND MANAGEMENT

Colorado State University, Environmental Resources Center. A. Klute, R. E. Danielson, D. R. Linden, and Philip Hamaker. December 1972. 51 pages.

PB–214 579

When ground water resources in dry areas are being mined for irrigation at a rate surpassing natural recharge of the aquifer, methods for increasing the recharge must be found if sound agricultural planning is to survive. The report covers various surface soil treatments and vegetation characteristics which were investigated in field experiments in Colorado to determine their effect on ground water recharge. Plots were established in 1967 on initially very dry soil of semi-arid native range land where the water table is about 100 feet below the surface. Water content profiles were measured periodically to determine the downward movement of water resulting from the surface treatments. Changes in the total water content of the profile were used to evaluate soil water accumulation and possible ground water recharge. A number of mulch, vegetation control and chemical-mechanical factors are considered.

PROCEEDINGS OF THE NATIONAL GROUND WATER QUALITY SYMPOSIUM

Environmental Protection Agency; and National Water Well Association. 1972. 217 pages.

PB–214 614

This document, which is comprised of papers presented at a symposium held in Denver, Colorado, August 1971, is intended to serve as a guide to the state of the art on ground-water quality. The topics covered include: the subsurface disposal of industrial wastes; petroleum pollution of ground water; ground-water pollution potential of a land fill above the water table; effect of early day mining operations on present day water quality; nitrate in ground water; use, abuse, and recovery of a glacial aquifer; salty ground water and meteoric flushing of contaminated aquifers.

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PB-215 218	$3.25
PB-215 265	$6.75
PB-215 328	$2.00
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PB-215 525	$4.85
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PB-215 617	$6.00
PB-215 694	$3.00
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